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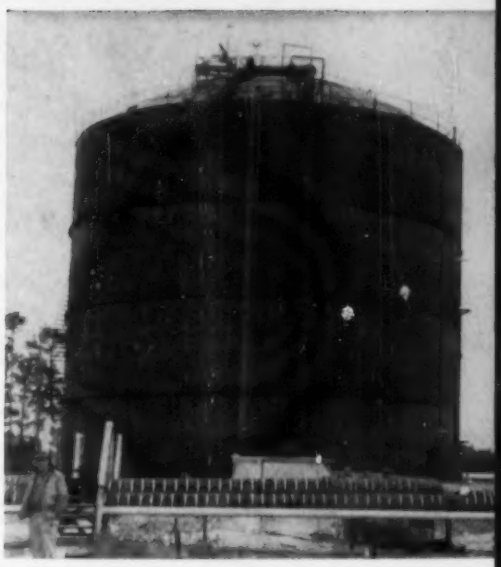
the OIL AND GAS JOURNAL

FEBRUARY 2, 1959

What unions say they want from management p. 53

Poor recovery predicted in Greater Aneth area p. 54

Salt storage of LPG is target in patent suit p. 58



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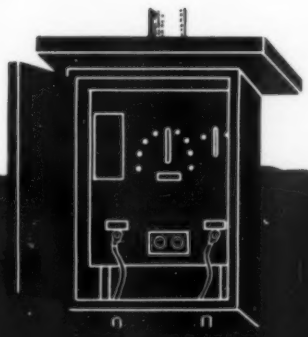

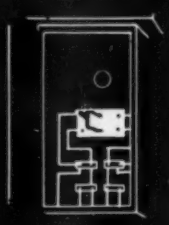

Rectifiers on bare pipeline save Sohio $1,000,000

. . . over and above initial investment and 5-year operating expense p. 80

PURPOSE AND TRADITION!

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When well site requirements exist, anywhere, anytime, and under almost any climatic condition, the men that answer your call, do so, with dedication to a basic principle, "We'll get there somehow safely."

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HALLIBURTON OIL WELL CEMENTING COMPANY DUNCAN, OKLAHOMA

the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
Feb. 2, 1959

Winter weather is causing some price didos:

Record demand has steadily pushed up distillate prices until they are now almost equal with gasoline prices.

Distillates in the mid-continent area went up another one-fourth cent last week. No. 1 is bringing 10.5 to 10.75 cents, and No. 2 goes for 9.75 to 10 cents per gallon. Both prices are close to regular gasoline.

On the gulf, kerosine brings 10.12 cents per gallon, just about the going rate for regular gasoline.

Distillate demand for last 4 weeks has averaged record 3,225,000 bbl. daily. Distillate output last week hit all-time peak of 2,144,100, higher than during Suez crisis. And stocks have dropped 47,685,000 bbl. in the last 42 days.

The situation calls for a sharp shift in refinery yields. Distillate cuts should be stepped up, gasoline cuts trimmed. And note: A long shutdown at Gulf's Port Arthur plant could aggravate the distillate shortage on the coast.

The Gulf strike stems from purely a local grievance.

Dispute involves management attempt to assign work—not wages. Union is agreeable to 5% raise which now is definitely the pattern over the U. S. and Canada (p. 59).

OCAW, however, reports deals are not uniform. Companies generally want the wage increases put into longer-term contracts. Some are attempting to tie strings to the wage offer.

▼ ▼ ▼

Two touchy spots in oil picture to watch:

...Crude prices are still changing. California Standard cuts price in Four Corners 10 cents from $3.00 to $2.90 bbl. on 25,000 bbl. Adjustments averaging 4½ cents also are made on lighter California crudes...Pure and Ashland have joined the West Texas-New Mexico cuts of 7 cents. So many big buyers have refused to go along, a major part of the production still is going at higher schedules.

...Active rotary rigs in U. S. and Canada last week were only 2,010. It's a drop of 15 in the week. Only encouragement is that size of the weekly drop is shrinking. By comparison, last year at this time active rigs totaled 2,083 and in 1957 total was 2,549.

Exploration east of the Mississippi is picking up despite record winter conditions.

Michigan is staging a real comeback with extensions to Scipio Trenton trend in southern rim of basin. Lease play is tremendous throughout southern part of state...Northern Ohio is also getting lease play after completion of 1,000-bbl. well in Perry County in Clinton sand. Drillers there are enjoying 72% success ratio...Pennsylvania-West Virginia wildcatting is uncovering new gas reserves. One of best is Glady field in West Virginia which has no dry holes...Spring also will see a return of barges to Lake Erie for more drilling on U. S. side where first production was tapped last year.

Texas' most southeasterly field has been opened with discovery of gas-condensate well south of Sabine Pass in Jefferson County.

Discovery is North Central Oil's 1-A Kountze & Stewart just inshore from an oil slick in the gulf which has been logged by navigators since the days of the Spanish explorers. Nearest other field is 7 miles.

Well is rated good for 37,000 M.c.f. of wet gas daily at open flow from Miocene sand at 8,606-10 ft. Gas-condensate ratio is 100 M.c.f. per barrel.

Prospects appear bright for California's offshore Parcel D which set a cash bonus mark for a U. S. marine lease.

Two favorable formation tests at undisclosed intervals are reported on first hole drilled. Texaco is continuing tests of the 7,513-ft. hole. Plans call for capping the well on ocean floor and drilling several more tests from present rig site.

Other owners of the $23.7-million lease are Monterey and Newmont.

▼ ▼ ▼

Future production trouble for Greater Aneth area is forecast in engineering study completed by Core Laboratories.

Study estimates 70% of Aneth's oil-in-place will remain in ground even with secondary recovery.

The outlook: Original oil-in-place put at 833,856,000 bbl. Primary recovery will get only 14.31%. Water flood would boost total take to 28.2%. Concurrent injection of produced gas would raise total recovery slightly to 29.7%.

Time to start big secondary-recovery program still is about 3 years off, report advises.

The IPAA is preparing to defend percentage depletion on both domestic and foreign production against any changes.

IPAA President Gordon Simpson warns the effort to cut the foreign depletion allowance would be the entering wedge for a broad attack on the depletion principle.

Studies show an increase of at least 5 cents per gallon in gasoline prices would be required to offset loss of depletion.

Proposed 4½-cent federal tax on jet fuel would deal staggering blow to airlines and hurt oil industry too.

Tax would equal 40% of jet fuel price. Since fuel is the major operating cost, fares would have to go much higher. This means less passengers, less flying, and less jet fuel demand.

Hardest hit would be nonsubsidized airlines which include most of the majors. Subsidized lines which are guaranteed a profit under CAB probably could absorb loss by getting larger subsidy.

▼ ▼ ▼

Gas lines of 42-in. diameter may appear in high-pressure U. S. transmission lines this year.

Several companies are studying the economics of 42-in. against 36-in. lines. Question is whether the 40% gain in capacity will offset higher construction costs.

Contractors estimate costs at from 25 to 60% higher for laying 42-in. than 36-in. Similar estimates were made when 36-in. came in—now it's laid for same price as 30-in.

If construction bids can be held down to 25-30% more than for 36-in., look for the 42-in. to be laid this year for the first time by a major transmission company.

Plans already have been drawn for a natural-gas liquefaction plant in Venezuela. It'll be built if voyage of the Methane Pioneer proves that liquid methane can be moved in ocean-going tankers.

Venezuelan plant will liquefy natural gas for European market, primarily England and West Germany. Plans also are being drawn for discharge and degasification plants in England and West Germany.

Look for natural gas liquefaction plants to be promoted in northeastern U. S. as standby facilities for meeting peak-day gas requirements of distributors (p. 51).

Price ceilings for natural gas may be announced soon by the FPC as a guide in setting rates.

FPC staff members reportedly are working on the price schedules for each major producing area in the country.

Drive for legislation to reduce price controls on independent gas producers, meanwhile, has reached stalemate.

Eisenhower apparently washed his hands of the issue when he ignored any gas bill in his budget message. Since then, advocates of the bill in Congress and the industry have been reluctant to act.

New tank-cleaning method has been tested by a major pipeline. Results indicate it can do a thorough job in a day or two with no shutdown.

Under the process, a solvent breaks up paraffin deposits on tank bottom and mixes the fresh oil with paraffin, which remains suspended in minute particles.

If process actually proves out, it will mean considerable savings over methods which require shutting down for a month or more to cut into the tank and clean it out.

▼ ▼ ▼

Bills before legislatures that bear watching:

...Nebraska—a bill would assess oil and gas as personal property and not real estate for taxation purposes. Of chief concern is proposal to tax oil and gas in place.

...Colorado—state-owned, tax-exempt property leased for longer than temporary use would be taxed as though lessee owned the property.

...Montana—minimum royalty on state oil and gas leases would be 12½%.

...Texas—bills would impose new 3% severance tax on gas reserves dedicated under long-term contracts and graduate the severance tax on oil production.

...California—new governor has started drive for a 2% severance tax on oil and gas production.

▼ ▼ ▼

Interesting statistics on engineering supply demand:

Freshman enrollment, latest count this year shows, has dropped to 70,129 compared with 78,757 last year.

Demand for engineers by American industry rose 27% from 1954 to 1957.

Federal manpower officials don't predict a future shortage of engineers, but the enrollment drop in face of increased need for engineers has them concerned.

Wage incentive plans are paying off big in greater productivity and lower unit wage costs. They also are boosting employe earnings.

A management survey shows that for every 1% increase in wages earned by employes productivity gained 3.1% and unit labor costs dropped 1.25%.

For petroleum and coal products industry a 24% increase in employe earnings was accompanied by a 96.5% productivity gain and a 26.5% cut in unit costs.

▼ ▼ ▼

Industry notes: Phillips has cheery outlook. Management reports if present trends continue 1959 profits should be highest in company's history. Keep that trend in mind while reading 1958 profits statement now coming out. Phillips' profits in 1958 dropped from $96.2 to $84.2 million...Jersey Standard went down from $805 to $564 million...Shell down from $135 to $116.5 million...Note how steel industry is preparing public for tough wage parleys with labor this summer. Ads appearing in newspapers stress cost of inflation and role the wage-price spiral plays in causing it.

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the OIL AND GAS JOURNAL

FEBRUARY 2, 1959 • VOLUME 57 • NUMBER 6

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TECHNOLOGY—OPERATION

Refining-Processing

Progress Report: Cat Reforming with RD-150 Catalysts 88

By W. H. Decker and C. Rylander

Sinclair's Houston reforming unit has processed more than 20 million barrels of naphtha with the initial catalyst charge, giving a catalyst life of 113 bbl. per lb. The unit ran continuously for 26 months, at an over-all stream efficiency of 95% before the first regeneration.

Engineering Flowsheets in Plant Design 92

By D. J. Oriolo

The first step in the detailed design of a process plant is the engineering flowsheet. It is the starting point and basis for all the activities entering into the definitive engineering and design of processing facilities. From the design criteria specified on the engineering flowsheet, requirements can be translated into the many working drawings and tabulations covering the complete plant assembly.

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The Foreman's Page 113

Use the right tank for your storage needs.

Questions on Technology 115

How size of fraction affects pour point.

Pipelining

Sohio Cathodically Protects Bare Pipe Economically 80

By L. H. West

Almost half of Sohio's high-pressure product pipelines are bare. Cathodic protection of the 206 miles of bare pipe is expected to save about $1 million over and above the initial investment and operating expenses in the first 5 years. These economic calculations are based on projection of leak-expectancy curves.

Pipe Failures: Causes, Effects, and Prevention 116

The use of chevron markings present on the fractured surface of a pipe failure is one of the most important developments in failure study. The markings point to the origin of the failure, and when the cause has been established, it has been possible to take preventive steps which prevented other failures.

Drilling-Production

Phillips Used Caution in Testing Deep Well 85

Production packers were used in the 1-EE University to isolate a zone from 24,897 ft. to total depth of 25,340 ft. The zone was treated and tested through perforations in the 5-in. liner, which is suspended 16 ft. off bottom.

Turbodrill: A Specialized Tool—Not a Cure-All 86

By W. B. Bleakley

An industry panel composed of equipment manufacturers and drillers outlines specifically where the turbodrill can be used economically, both with diamond bits and with rock bits.

Separator-Capacity Charts Mislabeled 87

K.D. Rig Knocks Down into Plane-Size Parts 98

A new deep-drilling rig, with equipment grouped into handy packages, can now make a complete move by air into inaccessible spots with little dismantling and confusion. International Brown Drilling Co. has come up with a carefully packaged 13,000-ft. rig which can be flown to the well site in C-82 Flying Boxcars.

Louisiana Onshore Drilling Costs 102

By Louis R. Records

Data for some 300 wells are presented graphically to show average drilling costs for onshore wells in South Louisiana. The money spent on mud is a major drilling cost, and the mud engineer should give the mud program detailed consideration. Mud conservation equipment seems to be a must.

Foaming Agents Revive Drowned Gas Wells 108

By H. N. Dunning and J. L. Eakin

These agents cause the "capture" of gas in the column of water. The result is the gradual lifting of this water, in the form of a light foam column, by gas pressures too low to lift the water column itself. Method is therefore applicable to wells so completely drowned that they do not deliver a measurable quantity of gas.

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NEW!

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"Over 450,000 feet of hole drilled with the same U. S. Royal 4 Rotary Hose"

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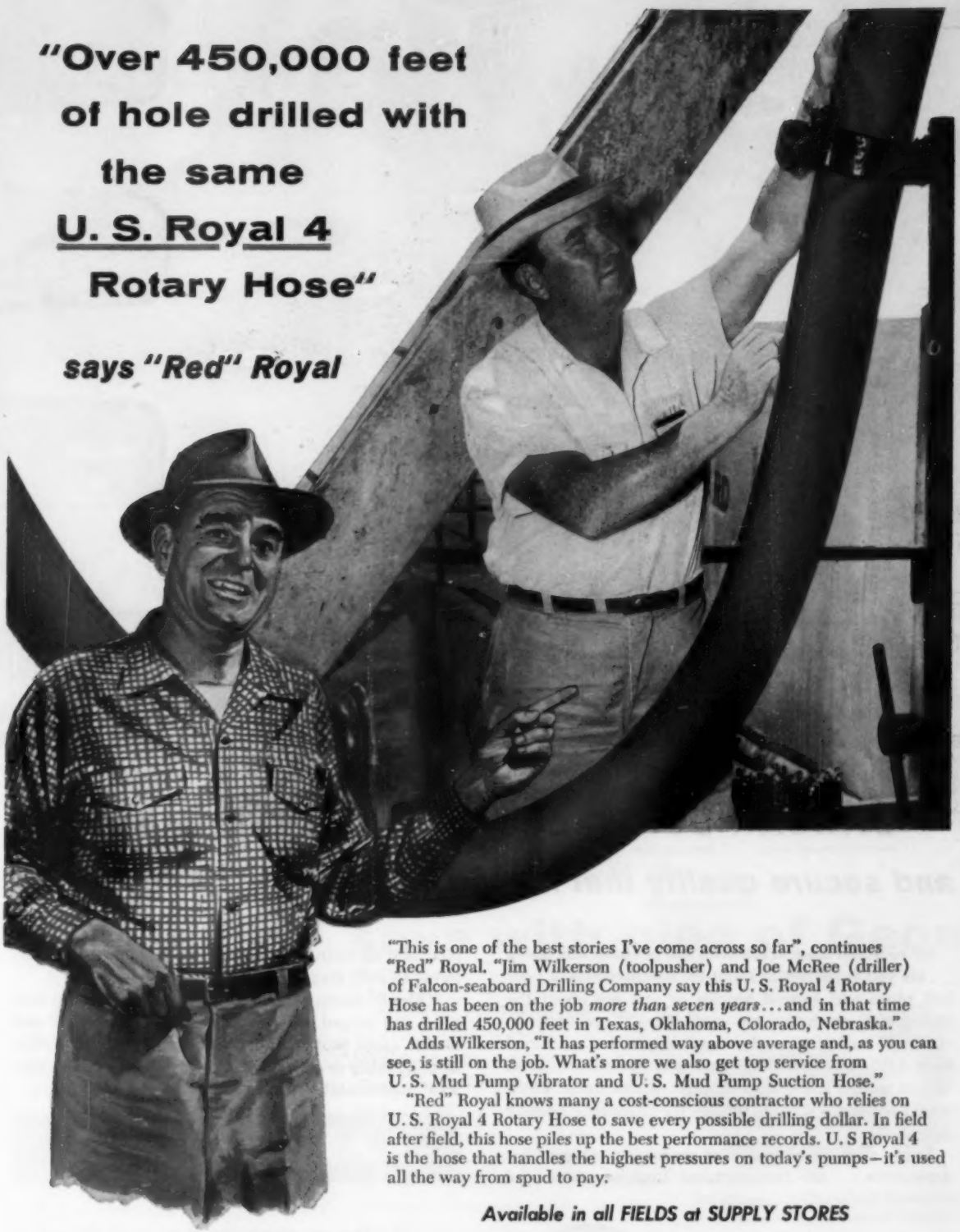

"This is one of the best stories I've come across so far", continues "Red" Royal. "Jim Wilkerson (toolpusher) and Joe McRee (driller) of Falcon-seaboard Drilling Company say this U. S. Royal 4 Rotary Hose has been on the job *more than seven years*...and in that time has drilled 450,000 feet in Texas, Oklahoma, Colorado, Nebraska."

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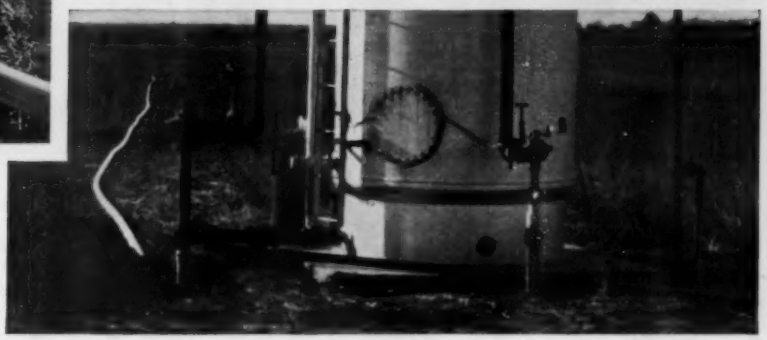
News about

B.F.Goodrich Chemical *raw materials*

Geon pipe running to tank battery and water separator in distance is concealed by freshly covered-over trench. Geon pipe is being used for oil and gas lead lines up to 250 psi working pressures.

Three-inch Geon pipe leads through fitting made of Geon into 4-inch salt water disposal pipe, also made of Geon.



Three-inch Geon pipe carries salt water from a crude oil de-watering tower to a disposal well 1000 feet away. It will be buried after a second line feeding into the disposal line is installed.

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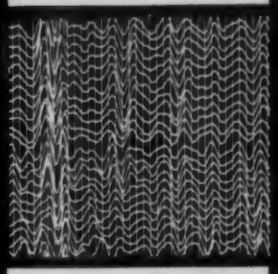
Where accuracy begins



Visit the research-development laboratories of General Geophysical Company in Houston, Texas. You'll find a hum of intelligent activity. The problem of the day may be the improvement of radio equipment for offset shooting. Or, perhaps it pertains to the development of a new seismic amplifier using transistors. Whatever the problem, you'll see progress in the making. These extra efforts to provide the most accurate field data for its clients have made General Geophysical Company synonymous with progress in geophysical instrument development and technique research. The extensive information and improved equipment resulting from this program are used on your prospect each time you place one of General's *experienced* crews in the field.

General's 12-man research-development staff works hand-in-hand with field crews. This co-operative teamwork has helped General to realize optimum equipment design for its field units.

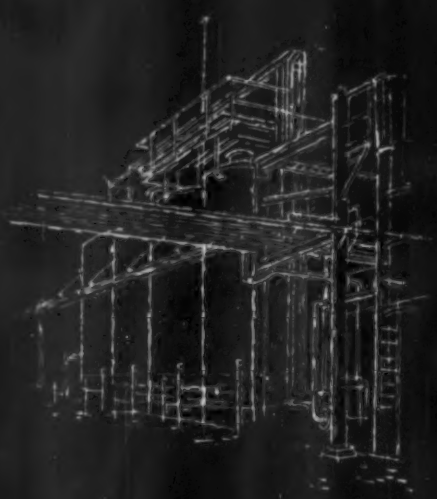
General

GEOPHYSICAL COMPANY

HOUSTON CLUB BUILDING • HOUSTON, TEXAS

In Canada: 10505 Elliott Avenue, Edmonton, Alberta, Canada
General Geophysical Company de France (SARL), 4 Square Rapp • Paris 7, France
General Geophysical Company de Venezuela, C. A., Sociedad A. Camejo No. 35 • Caracas, Venezuela
General Geophysical Company (Bahamas) Ltd., Bogota, Columbia

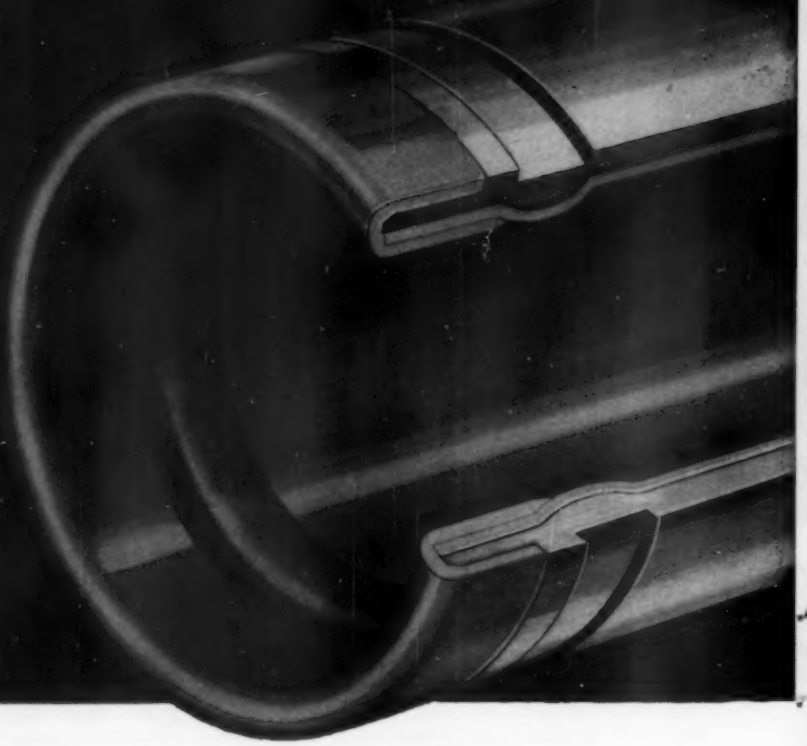
WHEN YOUR CONTRACT IS WITH GENERAL, THE PERCENTAGE FOR SUCCESSFUL EXPLORATION IS IN YOUR FAVOR



NEW "JAL-

handles corrosive liquids

- at pressures to 1000 P.S.I.
- at temperatures to 150°F.



New "Jal-Jacket" pipe, combining the corrosion resistance of rigid polyvinyl chloride with the strength of steel, offers you these cost-cutting advantages:

LONGER SERVICE LIFE. The superior PVC liner has corrosion-resistant properties required by the petroleum industry. The ends are fully protected with plastic to provide continuous protection from chemical attack. The thick liner eliminates costly flaking and pinholes. Steel jacket assures a tough, rugged product. Trial installations have been in service under severest conditions for two years.

LESS PARAFFIN BUILD-UP. The PVC liner minimizes paraffin build-up and hardness deposits. Exceptionally smooth I.D. maintains greater flow capacity.

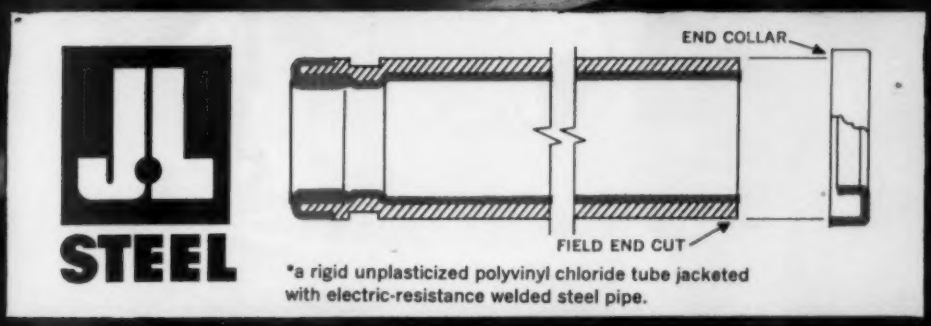
HIGHER WORKING PRESSURES. Strong steel jacket permits working pressures of 1000 p.s.i., where ordinary plastic pipe is limited to low pressure use.

EASY INSTALLATION. Ends grooved for Victaulic couplings permit quick joint make-up. Pipe can be cut to length in the field. Entire systems can be dismantled and re-assembled without damage to lining.

Jones & Laughlin Steel Corporation

PITTSBURGH, PENNSYLVANIA

JACKET" PIPE*



J&L STEEL

*a rigid unplasticized polyvinyl chloride tube jacketed with electric-resistance welded steel pipe.

"Jal-Jacket" is currently available in 20 foot mill lengths in three sizes, 2⅜", 3½", 4½" O.D. Get complete details by mailing this coupon today.

Jones & Laughlin Steel Corporation
3 Gateway Center, Pittsburgh 30, Pa.

☐ Send information on "Jal-Jacket"
☐ Have J&L representative call

Name_____

Title_____

Company_____

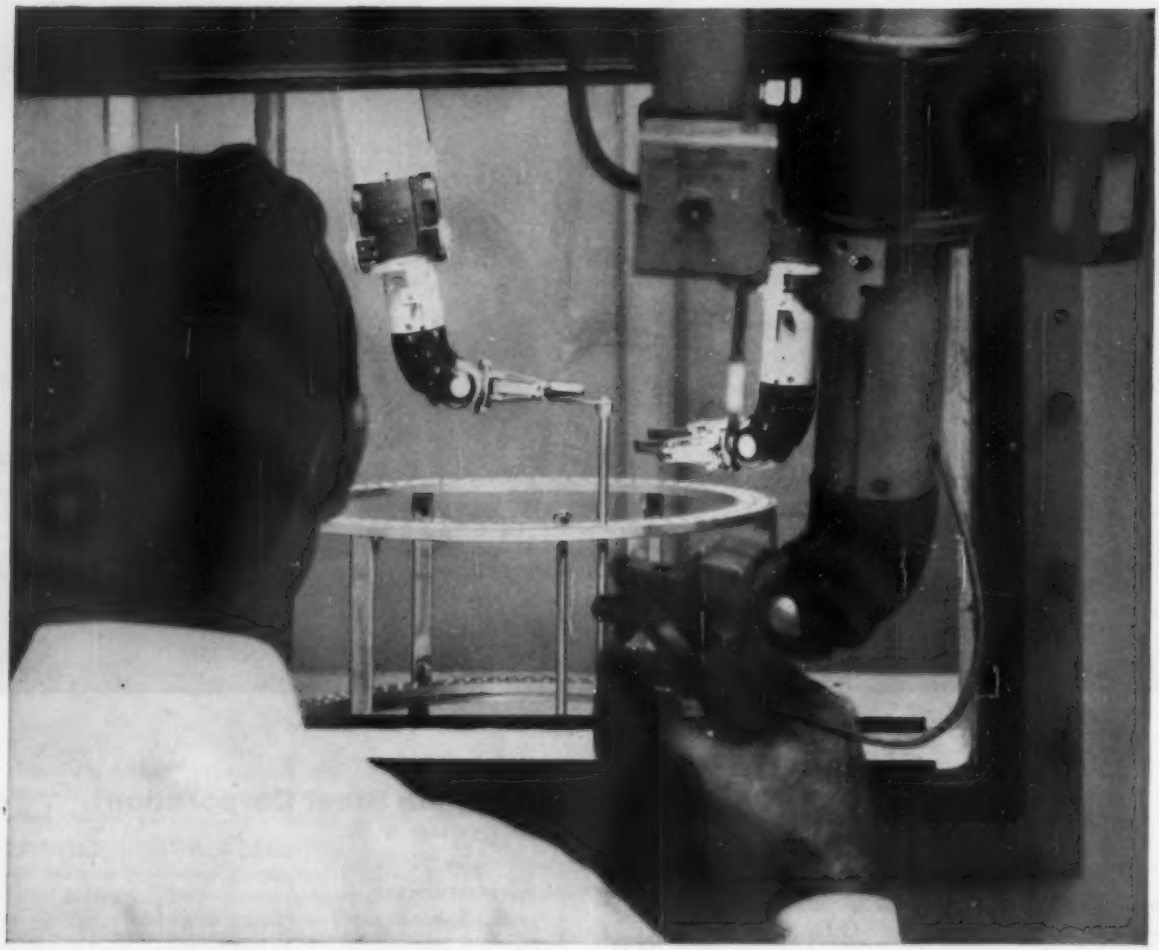
Street_____

City_____ State_____

NEWS ON TEXACO PROGRESS—RESEARCH

Oil research—from test tube to radioactive cobalt

YESTERDAY. Decades ago, Texaco scientists worked with relatively crude laboratory equipment, as they probed the fundamental mysteries of oil. Nevertheless — though early oil research was primitive — it resulted in important improvements in petroleum products. Many of these improved products were pioneered by Texaco.



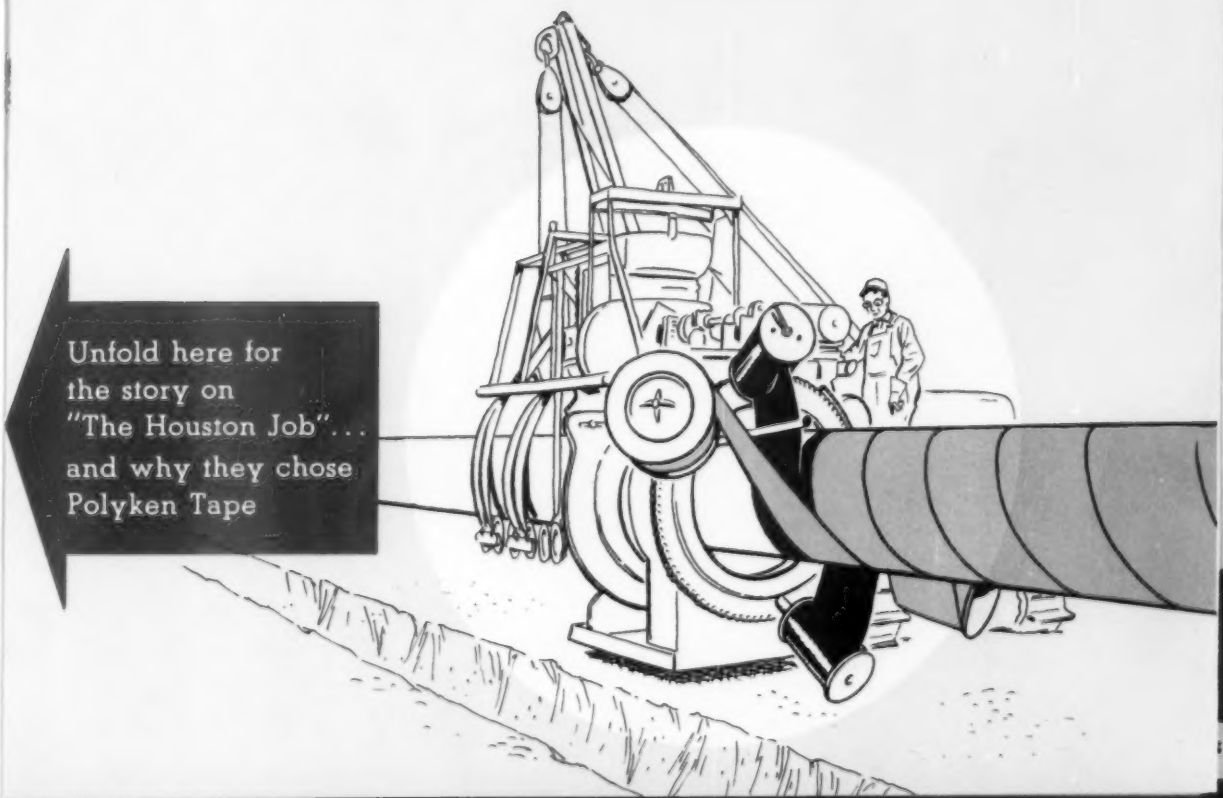
TODAY. Texaco scientists continue their search for basic petroleum knowledge, now using such ultramodern tools as radioactive Cobalt-60 in one of the world's most fully-equipped industrial research laboratories. This is only part of Texaco's great research center at Beacon, N. Y., one of the Company's four modern research centers. Hundreds of Texaco scientists are continually working to create new and better products for more and more people.

TEXACO

...CONSTANT PROGRESS IN OIL'S FIRST CENTURY

1,616-mile pipeline gets a modern coat

The largest single order ever placed for a protective pipeline coating of any kind specifies: POLYKEN®



Unfold here for the story on "The Houston Job"... and why they chose Polyken Tape

Why "Houston" chose Polyken tape

first they confirmed its performance... then they added up the cost estimates and came out half a million dollars ahead

When it came to selecting a coating material for their 1,616-mile line into Florida, the Houston Texas Gas and Oil Corporation took a good, hard look at Polyken Tape . . . because of its successful record on other major lines.

First, they had their engineering staff give it intensive corrosion-resistance and other performance tests. They checked the experiences of other large users. They designed comparative test spreads so they could see the actual difference in unit operations and costs between Polyken and the ordinary enamel method. And, according to O. Paul Herzig, Vice President in charge of Engineering and Construction, Polyken passed with flying colors.

Then they started adding up the dollars and discovered that a Polyken-wrap job would save them better than half a million dollars, compared with the conventional "hot dope" coating.

On one spread plan, for example, they found that the use of Polyken Tape would cut the coating labor force from 36 men to 19, and the construction equipment units from 18 to only 7.

Confirming these initial conclusions, Polyken has been consistently racking up an impressive on-the-job record for Houston. In practice, Polyken is using even fewer men and less equipment than in the test plans.

Another way it is demonstrating its superiority over enamel is in its "quick ditching" ability. This has proved particularly important in conditions of slushy sand, where a fast-collapsing ditch calls for immediate coating and lowering. Imagine—cleaning, wrapping and lowering only 75 feet behind the ditcher.

Another advantage: Polyken lessens liabilities as the pipeline moves through valuable orange groves, timberland and congested areas, where excessive hot dope equipment and fumes can be very damaging.

And instead of the anticipated mile-a-day rate, the Houston job has been moving at better than a mile and a half a day—over 50% faster than expected.

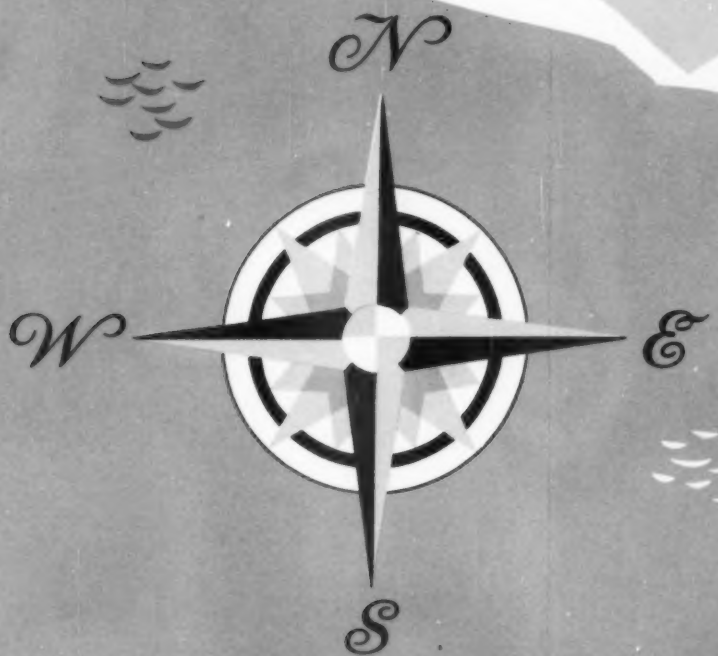
• Over 10
swamp,
water cro

• 914 miles of main line and 702 miles of branch lines (18" and 24" pipe).

ROUTE OF THE 1,616-MIL

100 miles of
, and fifty
crossings.

• 1,000 miles of timberland, including the DeSoto National Forest in Mississippi and the Ocala National Forest in Florida.



• 108 miles of main line parallels the Florida Sunshine State Parkway.

ILE HOUSTON TEXAS GAS & OIL CORPORATION PIPELINE

Line will use 42 million square feet of Polyken Tape (enough to pave a foot-wide path from New York City to Nome, Alaska, and back).

The Houston line is simultaneously cleaned and wrapped. Polyken Tape (dark spools) goes on, without a primer, in factory-uniform condition . . . then is overwrapped (as shown by gray spools).

Houston gets Polyken-wrapped pipe into the ditch almost immediately after coating. Field men say this method makes for a tight, clean, fast spread.

One of the toughest pipelines heads for Florida through forest, river and swamp

Take a look at the 1,616 miles of pipeline to be Polyken-coated by Juno

"This one's a lulu" was the way a crew chief put it last week after wading waist deep through Louisiana swamp.

The "lulu" he referred to is the Houston Texas Gas and Oil Corporation's new natural gas pipeline, now burrowing its way through some of the country's toughest terrain.

There's over a hundred miles of sloshy swampland, eager to make life miserable for a big-inch crew . . . a crew that's fighting time every little-inch of the way. When the swamps give out, there's rugged timber country—endless miles of it—and there are no less than 50 water crossings to be made.

In total, it involves a 1,616-mile trek from Baton Rouge to Miami. The pipe (914 miles of main line and 702 miles of laterals) ranges from 18" to 24" in diameter.

When the new line opens this summer, it will carry 278,000,000 cubic feet of natural gas daily to a Florida market of over 4,000,000 people.

Why you should choose Polyken tape

Tape is the modern way to coat a pipeline.

Not that it is new. Polyken pioneered polyethylene tape coating years ago . . . and every year more owners and contractors are switching to Polyken.

Polyken Tape is gaining greater acceptance for two big reasons—initial *construction* economies, and long-range *performance* economies.

Money-saving *construction* advantages like these:

1. **Substantial labor and equipment saving due to simplified operation.**
2. **Faster construction—consistent high daily output.**
3. **No hot dope preparation—tape is always ready.**
4. **No drying or cooling time. Simple clean-wrap-and-lower operation makes for a tight spread and closer supervision.**
5. **Vastly reduced warehousing, shipping, handling costs.**
6. **Liabilities virtually eliminated—no fumes, no burns, no need to worry about human and livestock hazards.**
7. **Wrap goes into ground in factory-uniform condition.**

Yes, Polyken protection saves big money during construction . . . and yet that's only half the story!

The really important savings—the long-range *performance* economies—come later, during long years of uninterrupted, reliable service.

Polyken polyethylene tape has remarkable durability . . . unexcelled corrosion resistance. It is made under precision-controlled factory conditions.

This means fewer holidays than any other coating. And fewer holidays mean lower maintenance and operating costs—year in and year out.

That's the proved record of Polyken Tape coating compiled under some of the toughest operating conditions.

THE MODERN WAY

Polyken®

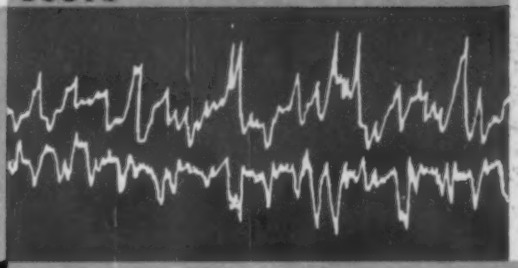
EXPERIENCED IN PROTECTIVE COATINGS

THE KENDALL COMPANY

Polyken Sales Division

PRINTED IN U.S.A.

TUBOSCOPE CUTS PRODUCTION COSTS



NEW SONOSCOPE INSPECTION OF USED TUBING

Detects Even Minute Corrosion Pitting

Gives Quantitative Results

100% Coverage of Tubing Wall

Sonoscope® inspection is the most accurate method of locating pitting, corrosion, and other faults on both inside and outside surfaces of used tubing. Tubing need not be cleaned for inspection. Inspection is performed at your well site. From the Sonoscope log, tubing defects can be more accurately evaluated than previously possible by non-destructive methods. Re-use tubing with complete confidence. Call TUBOSCOPE

Tuboscope COMPANY

2919 HOLMES ROAD, HOUSTON, TEXAS

Write for additional information, Dept. 118, P. O. Box 808, Houston 1, Texas

ACROSS 20 MILES OF OPEN SEA

Motorola Microwave controls offshore oil production

Off the coast of Louisiana, a Motorola microwave installation will soon be installed for CATC. 120 of its 175 miles is over open water, connecting 9 of 11 stations in a unique "loop" that provides maximum communications reliability. Should a transmitter, receiver or complete RF rack fail, the signal path could automatically change in 2 seconds, continuing service until repairs are made and the "loop" restored.

Soon, "add-on" equipment will provide automatic control and telemetering, making it possible for many of the platforms to be entirely unmanned except for maintenance visits.

Today in hundreds of inland drilling, pipeline and refinery operations, dependable Motorola microwave is used to read gages . . . to open and close valves . . . to start and stop motors . . . in addition to carrying voice and printed messages to and from centralized control centers. All this at the lowest per mile operating and maintenance cost.

Send today for Motorola's simplified microwave story . . . it will help you determine which combination of microwave uses best fit your operations.

THE COMMUNICATIONS SPECIALISTS TO INDUSTRY AND GOVERNMENT

MOTOROLA MICROWAVE

Motorola Communications & Electronics, Inc., 4501 West Augusta Blvd., Chicago 51, Illinois • SPaulding 2-6500 • A Subsidiary of Motorola, Inc.

Spotlighting 2 NEW VOGT VALVES

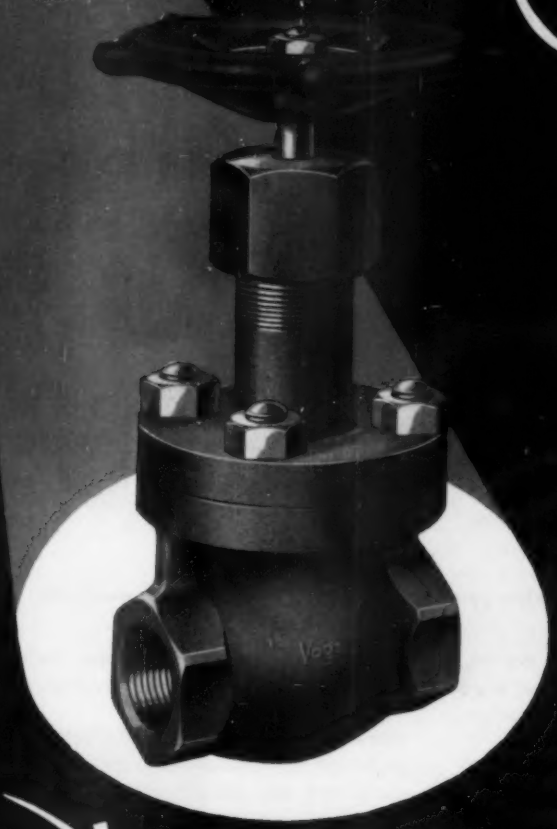
★

FORGED STEEL

INSIDE SCREW

Bolted Bonnet

GENERAL GP PURPOSE



GATE and GLOBE VALVES

150-800 Pounds Service

2000 Pounds Cold, W.O.G.

Available from stock in ¼" thru 2" sizes and in both socket weld and screw ends.

CHECK THESE FEATURES

1. Forged steel pressure containing parts designed for light weight and brute strength.
2. Hard faced seats and hardened discs and wedges.
3. Spiral wound stainless steel or Monel gaskets to suit trim.
4. Extra deep stuffing box for long packing life.
5. Dished sure-grip handwheel.

Write for literature Dept. 24A-FO

HENRY VOGT MACHINE CO., LOUISVILLE, KY.

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Vogt GENERAL GP PURPOSE Vogt THE BEST IN VALVES & FITTINGS

FORGED STEEL

VALVES

1958...*A Year of Historic Growth and Earnings*

CAPITAL AND SURPLUS
ONE HUNDRED MILLION DOLLARS

TOTAL RESOURCES NOW OVER
ONE BILLION DOLLARS

Statement of Condition

December 31, 1958

Resources

Cash and Due From Banks	$ 274,368,288.19
U. S. Government Securities	158,358,811.69
State, Municipal and Other Securities	19,665,602.81
Stock in Federal Reserve Bank	3,000,000.00
Loans and Discounts	528,423,370.76
Bank Building and Equipment	24,343,367.98
Customers' Liability on Acceptances	28,828,030.44
Other Assets	1,317,687.71
TOTAL	$1,038,305,159.58

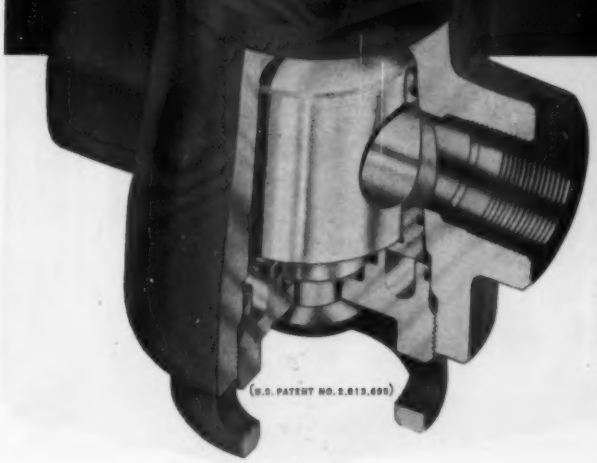
Liabilities

Capital	$ 37,866,576.00	
Surplus	62,133,424.00	
Undivided Profits	1,105,560.60	$ 101,105,560.60
Reserve for Contingencies		12,834,697.00
Reserve for Taxes, et cetera		7,204,217.11
Acceptances Outstanding		31,020,030.44
Deposits:		
Individual	$639,894,021.50	
Banks	227,627,415.40	
U. S. Government	18,619,217.53	886,140,654.43
TOTAL		$1,038,305,159.58

REPUBLIC NATIONAL BANK
OF DALLAS

HALLIBURTON

LO-TORQ PLUG VALVE



surpasses existing field requirements

A new development by Halliburton... the most versatile plug valve ever designed for the higher working pressures and low torque operations... yet dependable under the most severe operating conditions. Its unequalled performance surpasses existing field requirements... is capable of carrying many varieties of fluids and slurries... in cementing, drilling, fracturing, acidizing and mud systems... functions at pressures to 15,000 psi... is strong and durable, yet light in weight.

Compare these features of the Lo-Torq plug valve with any other plug valve!

• **ECONOMY**... low initial cost—economical to maintain—parts easily replaced in the field.

• **DEPENDABILITY**... performs under the most severe and rugged field conditions—meets with Standard A. P. I. Testing Procedure for *drilling* and *production* plug valves.

• **DURABILITY**... body forging and adjusting nut of heat treated alloy steel is designed for greater dependability, minimum weight and maximum strength, passing destruction tests of 35,000 psi... split-tapered inserts permit easy one-time adjustment.

• **LOW TORQUE**... extremely low torque required makes valve more easily operated. Torque is reduced by use of a balanced cylindrical plug which is not subject to longitudinal loads. Simple adjustment sets the valve for the correct operating torque.

• **VERSATILITY**... performs with highest efficiency in all liquid, gas and slurry applications... in cementing, drilling, fracturing, acidizing, mud systems and numerous other applications.

• **AVAILABILITY**... immediate shipment of 1" or 2" sizes with split-tapered inserts in either non-ferrous alloy or durable cast iron direct from the factory at Duncan, Oklahoma.

Call your local Halliburton Representative... ask him for prices and new brochure on the "LO-TORQ PLUG VALVE" by Halliburton.

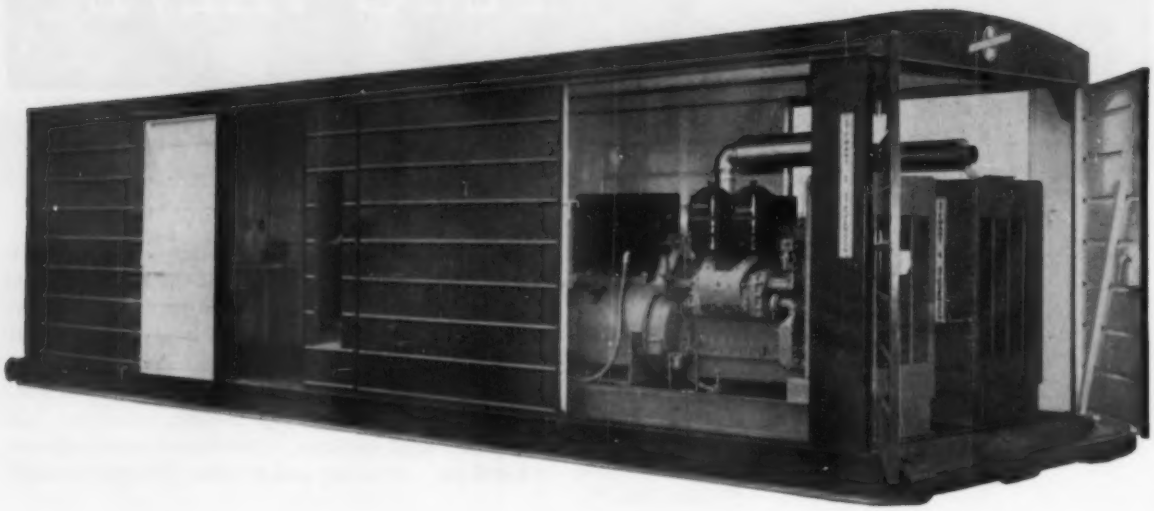
HALLIBURTON
CEMENTING SERVICES

"EXPERIENCE AND KNOWLEDGE...THE HALLMARK OF HALLIBURTON SERVICE"

HALLIBURTON OIL WELL CEMENTING COMPANY • DUNCAN, OKLAHOMA

From Stewart & Stevenson

NEW PORTABLE POWER PLANT



Complete with power plant, machine shop or field office

Here is a completely new portable power plant design, now available in sizes ranging up to 1000 KW, adaptable to skid or trailer mounting.

Units like the one shown are now in service throughout the Southwest and in many foreign locations, providing dependable electric power for lighting and general purpose use. This unit has two Model 6-GD75, Stewart & Stevenson General Motors Diesel powered AC Generator Sets, rated 75 KW each. Space is provided in the unit for a machine shop, storage or a field office.

Particular attention has been given to the design of the enclosure on Stewart & Stevenson Utility Units and Generator Sets. For example, the unit featured here utilizes formed channel sections and framing which greatly reduces weight while actually providing greater strength and rigidity.

The unit illustrated is only one of the many combinations available. Let us know about your requirements for portable power. Designing units for the unusual and "tough" jobs has always been a Stewart & Stevenson specialty. Call, write or wire today.

ASK US FOR DETAILS ON THE 10 NEW MODEL GM DIESELS FROM 20 HP TO 1350 HP. AVAILABLE FROM STEWART & STEVENSON

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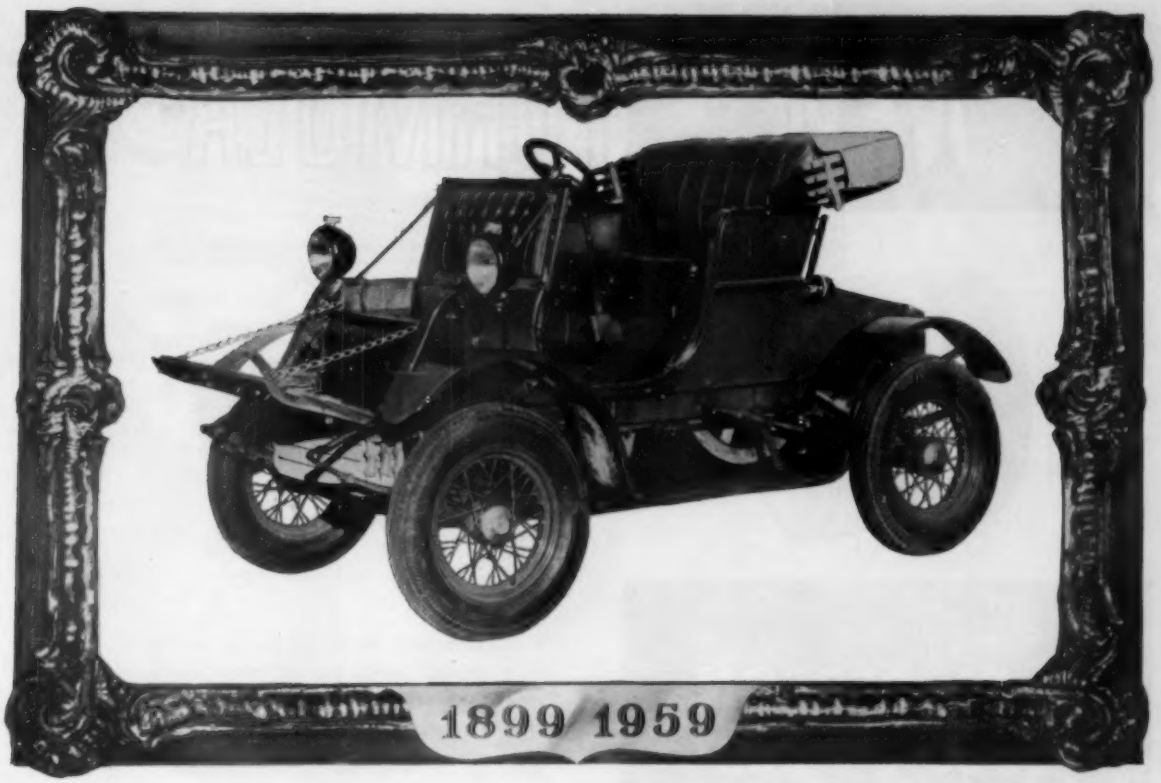
STEWART & STEVENSON

THE WORLD'S LARGEST DISTRIBUTOR OF DIESEL ENGINES



Everything's changed but the trademark on the bearings

BUILT by the St. Louis Motor Car Co. in 1899, this car was the first equipped with Timken® tapered roller bearings. It's still running. And today every make of American car but one uses Timken bearings. The things that the trademark "Timken" stands for haven't changed. It still means the highest quality, the best-known name in bearings, and the kind of service you can't get anywhere else. It means better performance with longer life and less maintenance in machine tools, steel mills, heavy construction machinery, farm implements and tractors —wherever wheels and shafts turn.

"Timken" is a registered trademark that identifies all products of The Timken Roller Bearing Company—tapered roller bearings, fine alloy steel bars, seamless steel tubing and removable rock bits.

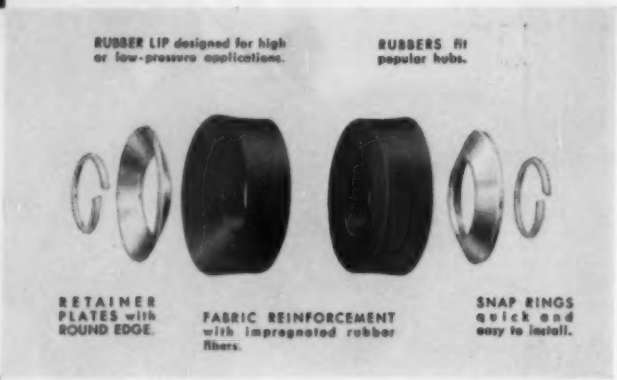
It's to your advantage to remember that "Timken" is not a type of product. It's your assurance of the best in tapered roller bearings, fine alloy steels and removable rock bits. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable: "TIMROSCO".

TAPERED ROLLER BEARINGS • REMOVABLE ROCK BITS • FINE ALLOY STEEL

TIMKEN®

first in quality for 60 years

NEW.. FORMULA-59


RUBBER LIP designed for high or low-pressure applications.
RUBBERS fit popular hubs.
RETAINER PLATES with ROUND EDGE.
FABRIC REINFORCEMENT with impregnated rubber fibers.
SNAP RINGS quick and easy to install.

GUIBERSON SLUSH PUMP PISTON RUBBERS *NOW* MEET ALL DRILLING CONDITIONS

Now Guiberson has developed a new, tough, oil resistant piston rubber compound.. specially formulated to extend piston and liner life and cut costly rig downtime.

Meeting the need for higher volumes and greater pressures, this special rubber compound is exceptional in its resistance to tearing and for its long life in pumping abrasive drilling muds.

The rubber section of Guiberson piston rubbers is firmly bonded to a heavy fabric backing for supporting maximum fluid loads. A special retainer plate with a rounded edge prevents cutting the rubber.. cause of many premature failures.

Guiberson piston rubbers are proving themselves after a year of punishing tests in the laboratory and in slush pumps on the rig. These rubbers are delivering outstanding performance through long runs under rugged drilling conditions.

Try them and see..
Guiberson rubbers are top quality
.. so order them now..
start cutting expenses.

Sold by
OIL FIELD SUPPLY STORES EVERYWHERE

THE
GUIBERSON
CORPORATION

ESTABLISHED 1919 — DALLAS, TEXAS U. S. A.

Link-Belt Chain is typical of the broad line of quality equipment stocked and distributed through National's 124 stores.

This is the National Supply Store, too!

The next time you stop in a National Supply Store, remember to shop *behind* the counter, too. You'll see quality equipment like this Link-Belt Chain, Ajax Engines, Oilmaster Pumps, Tube-Turn fittings, Rockwell-Nordstrom Valves and many more. In the warehouse, and other parts of the store you may not often see, is the secret of National's—and your—success.

On the next pages: Three National products for new drilling efficiency!

THESE NATIONAL COMPONENTS CAN LOWER

New NATIONAL Micromatic Drilling Control

Usable on almost every drawworks, new or used, National's new Model #6 Drilling Control is more compact, lighter and less expensive than the familiar Model #4. Essentially, it's an automatic driller, because it operates the drawworks brake just as the most experienced driller does—and insures the exact penetration rate desired.

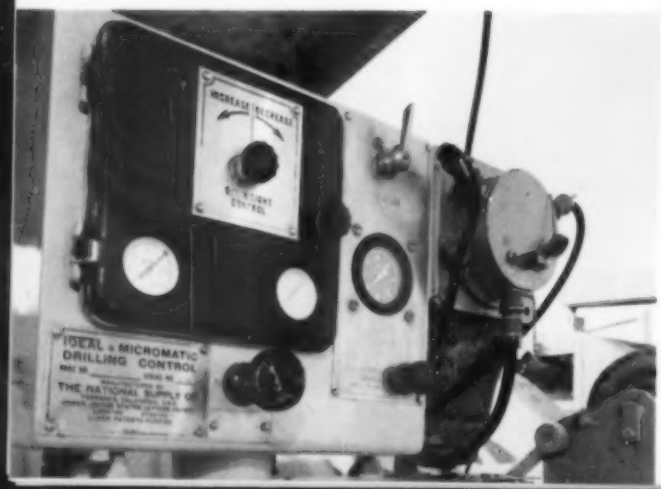
The driller first obtains the desired amount of weight on the bit; snaps and locks the control connecting rod to the brake lever and then opens two air valves in the control cabinet. The Micromatic Drilling Control then takes over the drilling operation and maintains the desired weight on the bit.

Feeding is smooth and continuous, the drilling string is under complete control at all times, weight on the bit can be increased or decreased at will and the control can be engaged or disengaged in a matter of moments! All controls, of course, are within easy reach of the driller.

You get many advantages with NATIONAL Micromatic Drilling Control. First, it's like doubling the drilling team without doubling the payroll. The result is reduced drilling time, whether through uniform or changing strata.

Micromatic Control is safe. Inoperation of any part results in nothing more serious than automatic restraint of feed off. All parts are rugged and conservatively rated. Naturally, this dependable control is thoroughly field-tested, in both straight and directional drilling. Remember, it's adaptable to any rig. Installation time is about six hours and can be done on location. Ask a National Supply representative to show and tell you more about it.

Micromatic Drilling Control automatically and constantly maintains a predetermined weight on the bit. ▶



◀ Micromatic Drilling Controls are within easy reach of the driller, and controls can be engaged or disengaged in a matter of moments.

YOUR DRILLING COSTS IMMEDIATELY!

NATIONAL Auxiliary Drawworks Drive consists of a small fluid coupling, scoop controlled, mounted on a countershaft on the front engine frame. Power is transmitted to this by a chain drive from the front drive group shaft.

New NATIONAL Auxiliary Drawworks Drive

Here is a new field-tested drive system that can lengthen the service life of your drilling engines, and help you perform many drilling jobs more efficiently! Named the NATIONAL Auxiliary Drawworks Drive or "Run-Around Drive," it permits all engines in a drive group *to operate as a single power unit while drilling*. But, at the same time, rotary speeds can be varied to meet all drilling needs.

To accomplish this, the NATIONAL Auxiliary Drawworks Drive simply diverts power (a maximum of 300 horsepower) from the combined power of all engines. This diverted power is used to operate the rotary via the drawworks under the very accurate control of a fluid coupling. Meanwhile, all the engines continue to run at a speed which adequately supplies the more extensive mud pump power needs. Of course, in a hoisting cycle when pumps are not in use, all power can be diverted.

As you can see, there are many benefits to this system. No single engine is lightly loaded or severely overloaded—a condition which frequently occurs without this drive. A number of rotary speeds can be selected accurately and quickly for various drilling conditions. And, this "cushion" drive for the drawworks and rotary permits fine control on delicate fishing jobs, core reel operations, tonging, wire line moving or renewal.

Get more information now on this outstanding NATIONAL Auxiliary Drawworks Drive! It can be tailor-made to fit your rig. Ask the National Supply representative in your area for complete details.

More on the next page . . .

PLAN NOW TO ATTEND

I.P.E. in TULSA

May 14-23

The biggest, most colorful show in petroleum industry history!

NATIONAL COMPONENTS FOR LOWER DRILLING COSTS (Continued)

New NATIONAL Pulsation Dampener

The NATIONAL Pulsation Dampener contains no rubber diaphragms, bags or sleeves. It operates on, but does not deplete, rig air supply.

The NATIONAL Pulsation Dampener is a pressurized air chamber device designed especially for use with large slush pumps. Based on a new principle, it completely eliminates rubber diaphragms, bags and sleeves. By effectively cushioning surges due to the pump's reciprocating action, this new dampener protects rotary hose, fittings and high pressure mud lines. It also safeguards the pump itself against premature leakage due to vibration. By reducing the wear and tear on fluid end and other parts, NATIONAL Pulsation Dampeners minimize the maintenance required on the entire mud system—and they do it with little care or maintenance themselves. Check the design features listed here; then contact the National representative in your area for all details.

DESIGN FEATURES

1. Completely eliminates troublesome rubber diaphragms, bags and sleeves. Only rubber element is a simple disc valve, which can be replaced easily and inexpensively.
2. Available as original equipment, or for replacement, on all large pumps.
3. Operates on rig air; no supply of high pressure air or nitrogen needed for precharging.
4. 5,000 psi working pressure, 8,000 psi test.

THE NATIONAL SUPPLY COMPANY

Subsidiary of Armco Steel Corporation

TWO GATEWAY CENTER, PITTSBURGH, PA.

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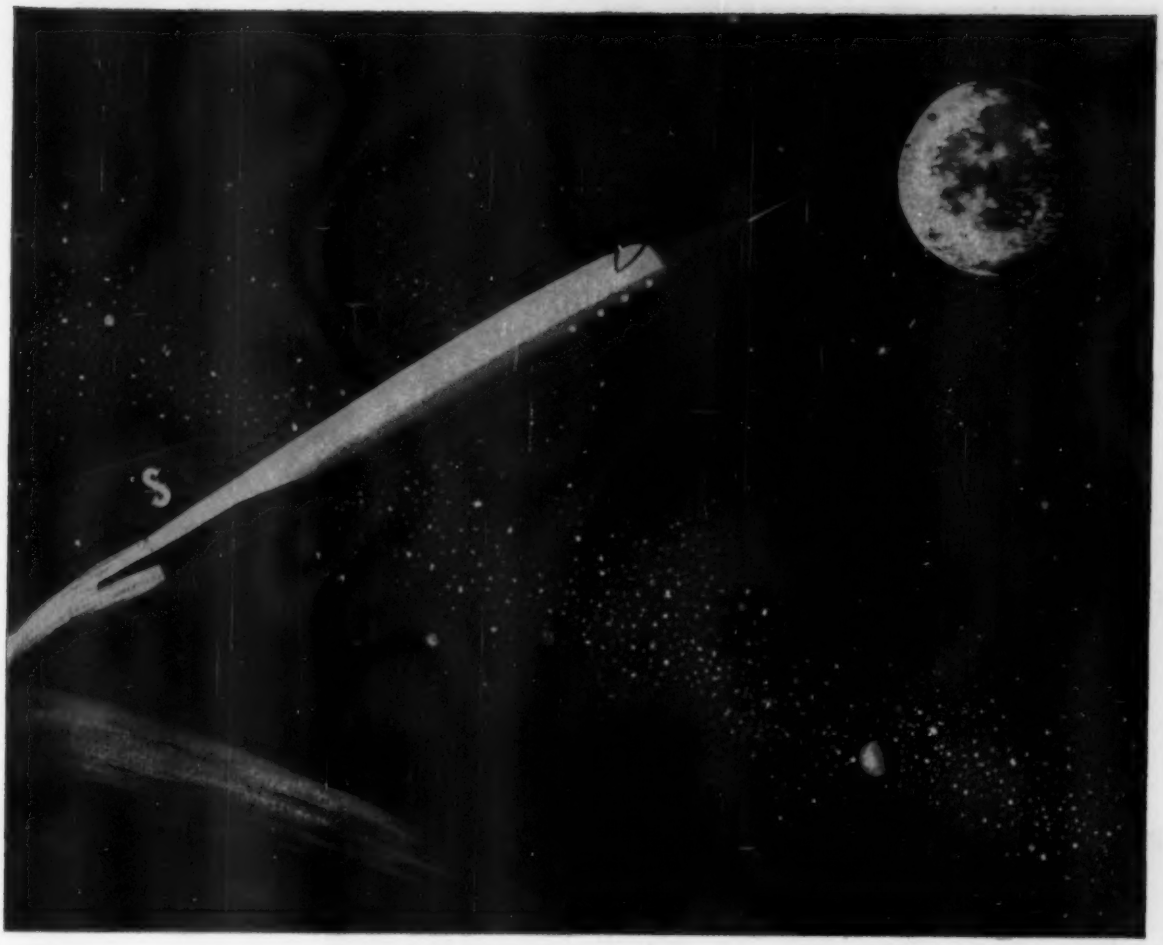
EXPORT: 600 Fifth Avenue, New York 20, N.Y., U.S.A.; City Wall House, Chiswell Street, London E.C.1



THE STOCKHAM WEDGEPLUG "O-SEAL"
. . As New as a Rocket Ride to the Moon

The first and only Steel Plug Valve that is positively Leak-Proof. The first cost is your *only* cost—continued costly valve lubrication is eliminated. Two Teflon "O" Rings in the plug give you a Double-Seal.

Extensive laboratory and field tests have failed to make the "O-Seal" leak.

The "O-Seal" offers you these advantages: Double-Block and Bleed, in most services; Constant Vapor-Tight Shut-Off; No Product Contamination—it's Non-Lubricated; Quick and Easy Operation.

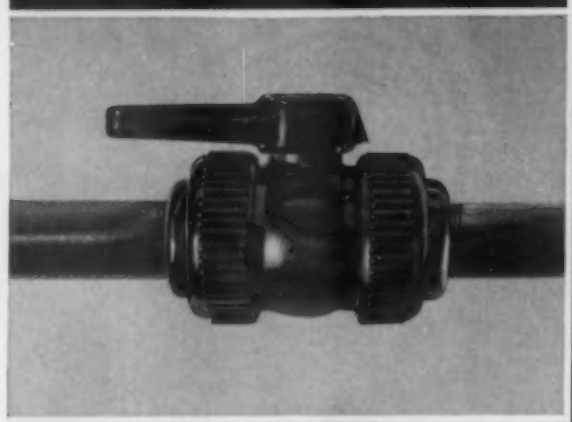
For the complete story, contact your local Stockham Distributor or Sales Representative.

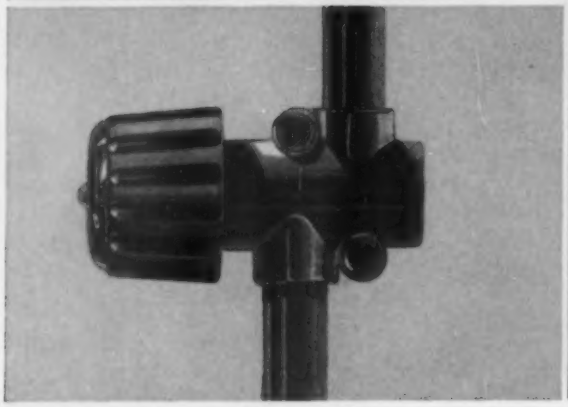
Write for the new brochure on the Wedgeplug "O-Seal"

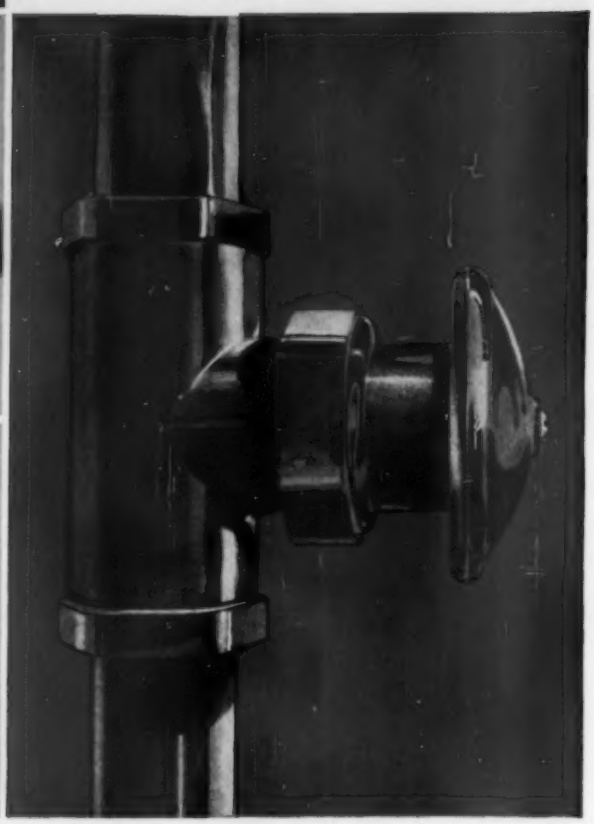
WEDGEPLUG VALVE COMPANY
Division of
STOCKHAM VALVES & FITTINGS
General Offices and Plant—Birmingham 2, Ala.

WEDGEPLUG "O-SEAL"—ANOTHER STOCKHAM FIRST

Naugatuck KRALASTIC







Now complete your system with corrosion-proof Kralastic Valves!

Kralastic®, the tough, chemical-resistant rubber resin material that has been adopted by pipe makers from coast to coast, used the world over, is now available in valves, too.

Now you can enjoy all the superior properties of Kralastic in globe valves, needle valves, ball valves, a wide variety of the most common types... in sizes from ⅛" to 3"...with still other sizes soon to come.

Lightweight, rustproof, rotproof, non-scaling, non-galling, impact-resistant, smooth-walled, self-lubricating, non-contaminating valves of Kralastic withstand working pressures as high as 180 psi, temperatures up to 140°F, as low as—20°F.

If you are presently using Kralastic pipe for only part of your system, now's the time to complete it with Kralastic. If you've been waiting until valves of this material became available, don't waste another day.

For more information on valves of Kralastic, write Chemtrol, Lynwood, Calif., Sloane Mfg. Co., Sun Valley, Calif., or the address below.

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Naugatuck Chemical Division

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HOMCO SUPPLY STORES

HOMCO *does the job*

supply and service in the roughest country

HOMCO portable gas compressor units have been designed for use in locations where moderate quantities of gas must be compressed for purposes such as gas lifts, injection, transmission lines and the like.

HOMCO portable gas compressor units are outstanding in performance, portability, flexibility and economy.

ALL HOMCO units are complete with necessary jacket water coolers, gas coolers and gas scrubbers. All piping between the component parts is supplied and mounted in HOMCO'S manufacturing plant in order that the units will be ready for immediate service upon reaching their destination.

HOMCO will furnish compressors to fit any individual specification.

THE WORLD'S LARGEST INDEPENDENT OILFIELD SUPPLY AND SERVICE ORGANIZATION
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OILFIELD SUPPLIES
ELECTRICAL WELL SERVICE

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HOUSTON, TEXAS

THE OIL INDUSTRY'S MOST COMPLETE SERVICE

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RESEARCH — DEVELOPMENT — ENGINEERING — MANUFACTURING

A look at today . . . and a glimpse

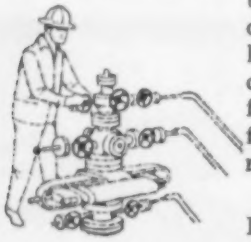
Armour Chemicals for Petroleum Production

Where they work today

Numerous applications for Armour Chemicals exist from the time a well is "spudded in" to the time crude oil is delivered to the refinery. Typically, these chemicals are used in mud drilling, give outstanding corrosion and bacterial protection in producing wells or fields under water flood, and insure corrosion protection in pipelines and terminal storage facilities.

In producing oil wells

Salts made from the Duomeens® (Armour's trade name for diamines), have gained wide acceptance in the petroleum industry as down-the-hole corrosion inhibitors. These oil soluble, cationic, hydrophobic salts form a tough molecular film on steel and markedly reduce corrosion.



Corrosion rates of 0.0014 IPY at a cost of 9 mils/bbl. are not unusual (based on 2 qts./100 bbls. producing fluid). Some of the salts made from Armour's Duomeens are shown at the bottom of the page.

For complete technical data, check "A" in the coupon.

For injection water treatment

Effective corrosion and bacterial protection in water flood operations are provided by Armour polar organic compounds at concentrations as low as 7 to 8 ppm (based on 100% activity). Armacs®, Arquads®, Duomeens and Duomeen salts are successfully being used for this application.

Typical treatment cost

Arquad T-2C-50	1.2 mils/bbl.
Armac CD-50	1.0 mils/bbl.
Duomeen CDA-50	1.1 mils/bbl.
Duomeen TDO-50	0.8 mils/bbl.

There is an effective Armour Chemical for every water system. The brine content of the water is one of the major factors determining the product to be recommended for use.

For example, high corrosion rates in a salt water disposal system in Western Kansas were greatly reduced by using only 6 ppm of Duomeen TDO, one of Armour's oil soluble, water dispersible inhibitors.

Armour's technical staff is continuing to field test many chemicals that will increase injection rates. Ethomeen® C/15, for example, is increasing injectivity at no increase in injection pressures in the Oklahoma and Pennsylvania fields.

Check "B" in the coupon for more information about Armour Chemicals applicable to water flood operations.

In product lines, transportation equipment and storage tanks

Pipeliners in many parts of the country are now using the Armeens®, Duomeens, or their salts, to protect pipelines from the costly effects of corrosion. By using these Armour Chemicals, operators are doubling —even tripling—life expectancy of pipelines.

Duomeen T dioleate

$$RNH(CH_2)_3NH_2 + 2C_{17}H_{33}COOH \longrightarrow \left[RNH(CH_2)_3NH_3\right]^{++}\left[OOCH_{33}C_{17}\right]_2^-$$

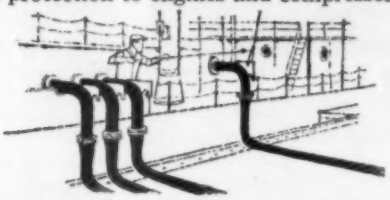
Duomeen T Di-Napthanate

$$RNH(CH_2)_3NH_2 + 2 \left[\text{naphthenic acid}\right] \longrightarrow \left[RNH(CH_2)_3NH_3\right]^{++}\left[\text{naphthenate}\right]_2^-$$

# of tomorrow

from Armour Chemical

Corrosion inhibition is achieved in gas line compressors by adding Arquad T-2C to cooling systems and radiators. Armac CD/50 also gives efficient, economical protection to engines and compressors.



The Duomeens are being used successfully to combat corrosion in refined product lines. Tankers are also being protected by these strongly cationic corrosion inhibiting chemicals.

More information regarding Armour Chemicals for these applications is available. Check "C" in the coupon.

Where Armour Chemicals for oil production will work tomorrow

Drilling muds. A relatively new Armour Chemical—Ethomeen S/12—is currently being tested as an emulsifier in drilling muds.

Acidizing and fracturing additives. It has been discovered that certain Arquads will form acid emulsions. The Arquads are used as emulsifiers in acid kerosene jets. They also control silicide swelling. In thickened oils they increase sand suspension. Test results show that extra corrosion protection for trucks and the tubing can be provided by the Arquads.

Water coning. Water production from coned wells has been reduced in a field test in Southern Louisiana by injecting two Armour surfactants in a water system. The treatment, based on laboratory work conducted by Dr. Alan S. Michaels of M.I.T. is also being field tested in other sections of the country to improve oil production.

Test and evaluate Armour's Chemicals for oil production. Our experienced oil chemists will help you determine the right chemical for your special problem. Send coupon—or call—Armour today!

NEWS NOTES

Houston. A new technique, showing the presence of hydrocarbons in thin sand beds and shaly sands normally by-passed by standard logging techniques, was discussed in a paper titled "Reversed Wetting Logging" at the recent S.P.E. meeting. The technique utilizes the hydrophobic-cationic characteristics of surfactants such as Armac® CD-50.

•

Tulsa. The Arquads®, quaternary ammonium chlorides, have now been completely cleared of being catalyst contaminants by at least three major refiners in the Southwest. There had been a tendency to class these excellent bactericides-corrosion inhibitors with chlorinated solvents.

•

Southeast Oklahoma. A new series of ethoxylated quaternary ammonium chlorides—the Ethoquads®—are showing promise for increasing injectivity here in field tests.

•

Hobbs, New Mexico. Clarification of injection water for secondary oil recovery is now being obtained through the addition of 0.1 pound of Arquad per ton of solids to be flocculated.

ARMOUR CHEMICAL DIVISION

Leader In Progressive Fatty Acid Chemistry

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Increase oil production with Armour Chemicals

Check here for more information on your field of interest. ☐ A ☐ B ☐ C OGJ-2-59

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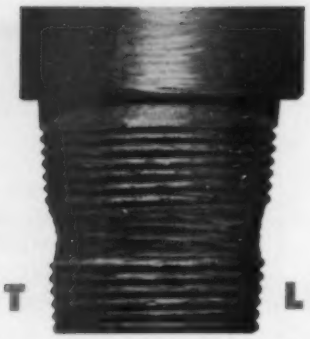

DON'T LET THIS HAPPEN TO YOUR TOOL JOINTS

This joint lost money for its owner because it was not properly doped. Properly made-up and lubricated with a WECO Tool Joint Compound zinc-base No-Gall or lead-base Lo-Tork, it would have been a money-maker.

WECO Compounds are made of 50% pure metallic lead or zinc dispersed in a neutral oil with a tacky additive. They always remain soft in the can under all extremes of hot or cold weather and never require thinning.

Low-friction make-up and positive resistance to squeezing out under pressure and high temperature make WECO Tool Joint Compounds perfect for every drilling program.

Add to the life of your drill string connections with WECO Compounds . . . No-Gall for those who prefer zinc base compounds; Lo-Tork for those who want a lead base compound. Your Supply Store carries complete stocks of both.

C-T-58

WELL EQUIPMENT MFG. CORP.
HOUSTON, TEXAS

WECO

Division of CHIKSAN COMPANY *a subsidiary of* FOOD MACHINERY AND CHEMICAL CORPORATION

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They Say-

Shades of Ichabod Crane

Dear Sir:

Your January 12 issue carried on page 49 the only picture I have ever seen of a human with a cement hose head. You might call him "nozzle nose."

Is this type of specialized worker common in the industry?

Fred H. Clark
Shell Chemical Corp.
Pittsburgh, Calif.

(Editor's note: We call him the Headless Hoseman.)

Add $10 million for Union

Dear Sir:

In the tabulation on page 49 of the December 22, 1958, issue of The Oil and Gas Journal, Union Oil Co.'s 1957 net income is incorrectly reported as $28,235,000.

We would like to bring it to your attention that the company's net earnings as reported in our annual report for 1957 were $38,235,535.

M. E. Joyce
Supervising Accountant
Financial Accounts
Union Oil Co. of California
Los Angeles.

Compliments on a change

Dear Sir:

May I compliment you on the inclusion of the issue number on every other page of The Oil and Gas Journal?

Many users of your journal, including Chemical Abstracts, will find that this change can make it easier to cite references.

Charles L. Bernier
Chemical Abstracts
Ohio State University
Columbus, Ohio.

How about complete index?

Dear Sir:

Recently I have had several occasions to search for articles published a number of years ago, 1920 to 1930, and have had great difficulty in locating the index for some of those years.

It has occurred to me that a complete index to the Journal for the period of 1920 to say, 1958, might serve a very useful purpose.

Such indices have been published for the American Institute of Mining,

NEW

MARK I CUP TYPE SWAB

PATENT PENDING

Companion to the Proved E-Z Swab, the new Mark I Cup Swab uses the same mandrel but different rubbers. Mark I is a heavy duty positive displacement type swab able to lift a fluid load of from 1,200 feet to the heaviest loads encountered. Mark I was designed for use where the unique features of the E-Z Swab are not required. Heart of the Mark I—see cutaway—is a solid steel reinforcing core. This solid steel core can't wear, bend, and break as conventional reinforcing wires can. Can't hang up in tubing the way wires can. The new Mark I falls fast and comes out full. All this and the famous Mission Guarantee: "In a competitive test it will outperform all others or your money back." Order through your favorite supply store. Get your copy of the new brochure.

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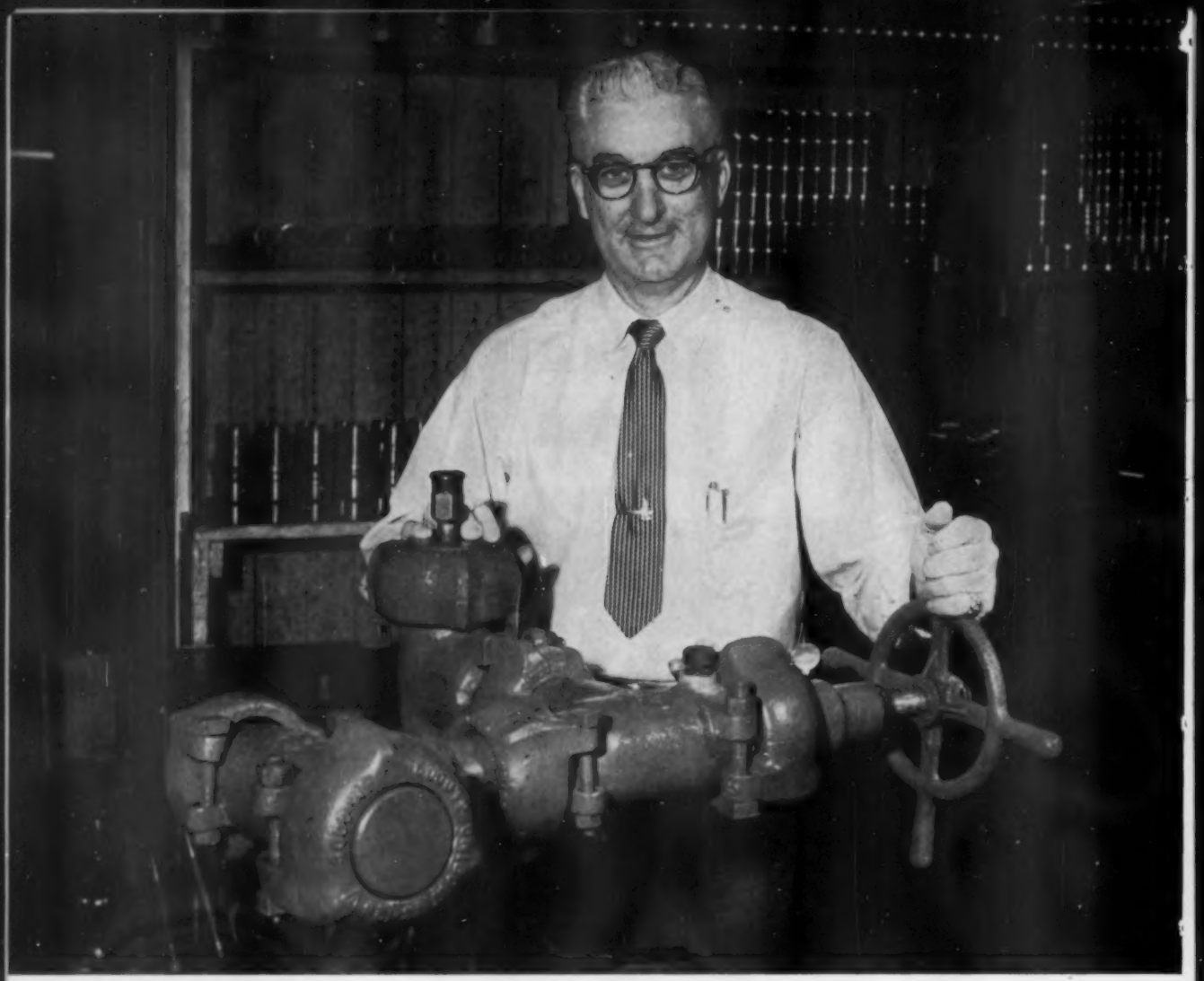

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Pound for pound, dollar for dollar, or by any other standard of comparison, UNIBOLT gives you more for your money than any other production manifold or flow control unit.

In addition to numerous mechanical refinements, many of which are exclusive, the UNIBOLT Flow Manifold permits the operator to select the manifold *best suited for his particular well requirements.* Unlike manifolds of fixed design, with UNIBOLT you buy only what you need and nothing more. Using three standard UNIBOLT products—Tee (or Cross for double wing trees), Adjustable Wing Valve, and Positive Choke Body or Cage Nipple and Bean—you have the choice of several combinations. Greater flexibility in arrangement of flow manifolds, complete salvage of parts for use elsewhere, either separately or as a unit, easy field maintenance—these economies and conveniences are yours exclusively with UNIBOLT.

Any UNIBOLT representative will gladly show you all twenty-four reasons why this production manifold is your best buy.

THORNHILL CRAVER CO.
P. O. BOX 1184 HOUSTON, TEXAS

Metallurgical, and Petroleum Engineers, for the American Petroleum Institute (1927-1933) and the American Association of Petroleum Geologists, but The Oil and Gas Journal, with its unique position in the industry, is still one of the most difficult in which to find much sought after articles.

Eugene A. Stephenson
Professor Emeritus
Department of Petroleum Engineering
University of Kansas
Lawrence.

Atomic air cooler in 1969?

"Within 10 years nuclear fission will be employed extensively to create both heat and electricity.

"In some parts of the world nuclear power is already competitive with conventional generating plants. The use of such heat or electricity to 'drive' air conditioning and refrigeration equipment should be an immediate, practical application."

Dr. J. F. Downie Smith, vice president in charge of research and development, Carrier Corp.

Boo for State Department

"United States oil companies are understandably annoyed at the Venezuelan Government's move to boost its share of profits, in violation of previous understandings, and the companies concerned have not hesitated to say so.

"For their outspoken comments they are getting their wrists slapped by the State Department.

"The department's reasoning is that angry words will not improve matters and may serve only to worsen them. As a general guide that is doubtless true enough, but it can obviously be carried too far. Is it up to the State Department to tell private businesses what to say and not to say?

"The chief function of a foreign office, after all, is the guarding of a nation's individuals and interests abroad. That ought to take precedence over any desire to be pals with other countries.

"Thus we have the curious spectacle of the diplomats' directing their indignation not at the offending government but at the injured parties they are supposed to protect."

Editorial in the Wall Street Journal.

Canada eyes British markets

"The idea that Britain should import oil from Canada goes back more than 20 years and hasn't been realized yet, but this doesn't mean that it's to be laughed off as something for the birds.

"The 'natural' outlet for our surplus is evidently the U. S., but experience shows that the Americans are not long-term reliable customers for anything they themselves produce. A decision taken now in Washington to regard North American oil reserves as a single pool for defense purposes—and so exempt Canada from restrictions on U. S. imports—might be reversed in 1, 2, or 5 years.

"Britain, unlike the U. S., is 100% dependent on outside oil sources and these are entirely under foreign (non-Commonwealth) political control.

"From the British point of view, an oil supply from Canada, friendly and peaceful, would be more reliable than a supply from the Middle East.

"The question is whether there is any substantial British support for the idea. Would the British be interested in financing a pipeline, seeing that it would be an investment in their own security and intended, possibly, only for occasional use? Alternatively, could Britain offer any assurance of a dependable market at an acceptable price?

"The questions are worth exploring. Canada's economy has been successfully built, it's worth keeping in mind, on the proposition that trade may be made to flow east-west when geography seems to demand that it flow north-south."

Editorial in the Toronto Financial Post.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR OF EVENTS

FEBRUARY

1-4 American Association of Petroleum Geologists, Rocky Mountain section, ninth annual meeting, Civic Auditorium, Albuquerque, N. M.

1-6 American Society for Testing Materials, D-2 committee on petroleum products and lubricants, Sheraton-Jefferson Hotel, St. Louis.

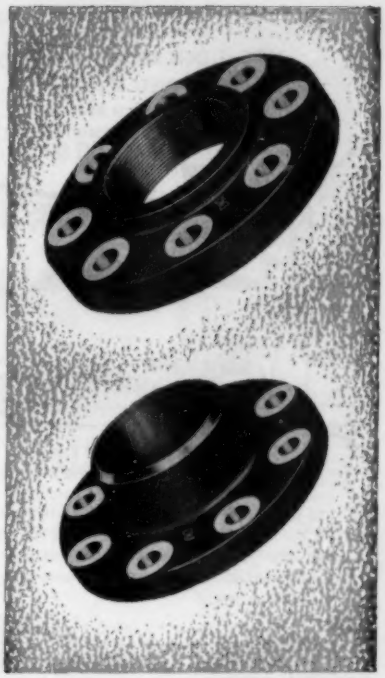
2-22 Southwestern Legal Foundation, short course on oil and gas law, Southwestern Legal Center, Dallas.

11-13 Southwestern Legal Foundation, tenth annual institute on the law of oil, gas, and taxation, Southwestern Legal Center, Dallas.

11-13 National Association of Corrosion Engineers, Tulsa section, tenth annual pipeline corrosion short course, Mayo Hotel, Tulsa.

15-19 American Institute of Mining, Metallurgical, and Petroleum Engineers, annual meeting, Sir Francis Drake Hotel, San Francisco.

16-18 American Management Association,



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FLANGES

Harrisburg Drop-Forged Steel Pipe Flanges are made to A.S.A. standards for oil companies, ship builders and pipe fabricators. They come in threaded, butt-welding, slip-on welding, Van Stone and blind types and are shot-blasted and dip-coat finished with a rust preventative black lacquer. Be sure you make it Harrisburg when you want flanges.

More than a Century H in Harrisburg 6, Pa.

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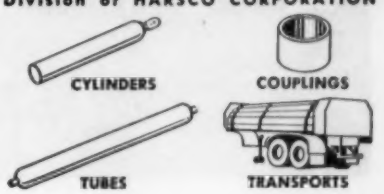

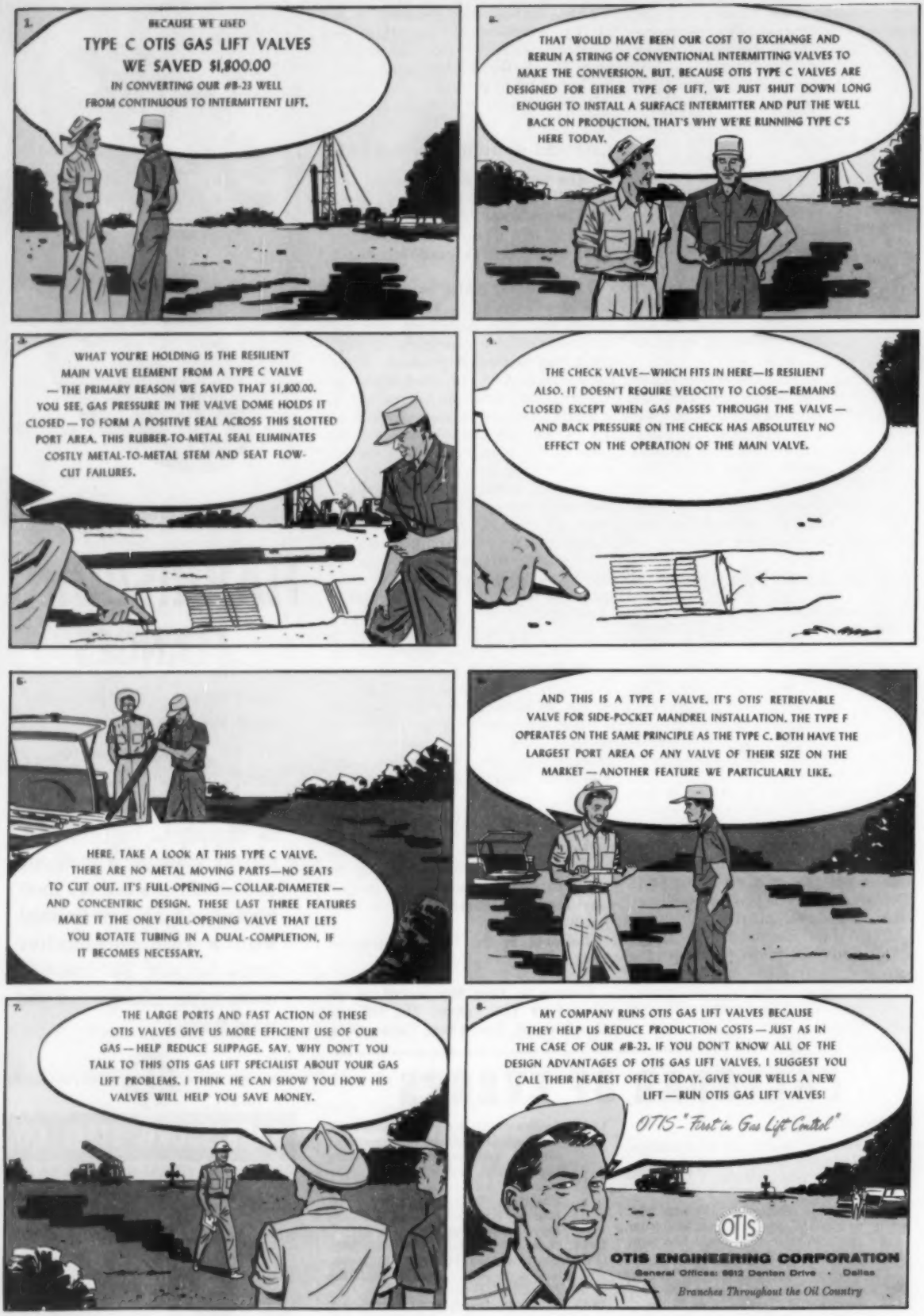
1.
BECAUSE WE USED
TYPE C OTIS GAS LIFT VALVES
WE SAVED $1,800.00
IN CONVERTING OUR #B-23 WELL
FROM CONTINUOUS TO INTERMITTENT LIFT.
2.
THAT WOULD HAVE BEEN OUR COST TO EXCHANGE AND RERUN A STRING OF CONVENTIONAL INTERMITTING VALVES TO MAKE THE CONVERSION. BUT, BECAUSE OTIS TYPE C VALVES ARE DESIGNED FOR EITHER TYPE OF LIFT, WE JUST SHUT DOWN LONG ENOUGH TO INSTALL A SURFACE INTERMITTER AND PUT THE WELL BACK ON PRODUCTION. THAT'S WHY WE'RE RUNNING TYPE C'S HERE TODAY.
3.
WHAT YOU'RE HOLDING IS THE RESILIENT MAIN VALVE ELEMENT FROM A TYPE C VALVE — THE PRIMARY REASON WE SAVED THAT $1,800.00. YOU SEE, GAS PRESSURE IN THE VALVE DOME HOLDS IT CLOSED — TO FORM A POSITIVE SEAL ACROSS THIS SLOTTED PORT AREA. THIS RUBBER-TO-METAL SEAL ELIMINATES COSTLY METAL-TO-METAL STEM AND SEAT FLOW-CUT FAILURES.
4.
THE CHECK VALVE—WHICH FITS IN HERE—IS RESILIENT ALSO. IT DOESN'T REQUIRE VELOCITY TO CLOSE—REMAINS CLOSED EXCEPT WHEN GAS PASSES THROUGH THE VALVE—AND BACK PRESSURE ON THE CHECK HAS ABSOLUTELY NO EFFECT ON THE OPERATION OF THE MAIN VALVE.
5.
HERE, TAKE A LOOK AT THIS TYPE C VALVE. THERE ARE NO METAL MOVING PARTS—NO SEATS TO CUT OUT. IT'S FULL-OPENING — COLLAR-DIAMETER — AND CONCENTRIC DESIGN. THESE LAST THREE FEATURES MAKE IT THE ONLY FULL-OPENING VALVE THAT LETS YOU ROTATE TUBING IN A DUAL-COMPLETION, IF IT BECOMES NECESSARY.
AND THIS IS A TYPE F VALVE. IT'S OTIS' RETRIEVABLE VALVE FOR SIDE-POCKET MANDREL INSTALLATION. THE TYPE F OPERATES ON THE SAME PRINCIPLE AS THE TYPE C. BOTH HAVE THE LARGEST PORT AREA OF ANY VALVE OF THEIR SIZE ON THE MARKET — ANOTHER FEATURE WE PARTICULARLY LIKE.
7.
THE LARGE PORTS AND FAST ACTION OF THESE OTIS VALVES GIVE US MORE EFFICIENT USE OF OUR GAS — HELP REDUCE SLIPPAGE. SAY, WHY DON'T YOU TALK TO THIS OTIS GAS LIFT SPECIALIST ABOUT YOUR GAS LIFT PROBLEMS. I THINK HE CAN SHOW YOU HOW HIS VALVES WILL HELP YOU SAVE MONEY.
8.
MY COMPANY RUNS OTIS GAS LIFT VALVES BECAUSE THEY HELP US REDUCE PRODUCTION COSTS — JUST AS IN THE CASE OF OUR #B-23. IF YOU DON'T KNOW ALL OF THE DESIGN ADVANTAGES OF OTIS GAS LIFT VALVES, I SUGGEST YOU CALL THEIR NEAREST OFFICE TODAY. GIVE YOUR WELLS A NEW LIFT — RUN OTIS GAS LIFT VALVES!
OTIS - "First in Gas Lift Control"
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seminar on management problems of exploration and production, Hotel Astor, New York.

18-21 National Society of Professional Engineers, winter professional meeting, Dinkler-Tutwiler Hotel, Birmingham, Ala.

24-25 University of Oklahoma, sixth geological symposium, Norman, Okla.

24-26 Oklahoma State University, natural-gas engineering conference, Stillwater, Okla.

25 Petroleum Equipment Suppliers Association, Mid-Continent and Rocky Mountain district meeting, Mayo Hotel, Tulsa.

26 American Society for Testing Materials, southwest district annual meeting, Houston.

26-28 Pipe Line Contractors Association of Canada, fifth annual convention, Castle Harbour Hotel, Bermuda.

27 Natural Gasoline Association of America, Permian basin regional meeting, Scharbauer Hotel, Midland, Tex.

MARCH

3 Petroleum Equipment Suppliers Association, Pacific district, annual membership meeting, Ambassador Hotel, Los Angeles.

4-5 University of Oklahoma, gas-processing conference, Norman, Okla.

4-6 American Petroleum Institute, Division of Production, southwestern district meeting, Hotel Scharbauer, Midland, Tex.

5-6 Southern Gas Association, transmission management conference, Jung Hotel, New Orleans.

6 Natural Gasoline Association of America, Gulf Coast regional meeting, Robert Driscoll Hotel, Corpus Christi, Tex.

7 American Chemical Society, Oklahoma tetrasectional meeting, University of Tulsa, Tulsa.

8-11 American Society of Mechanical Engineers, gas turbine power conference and exhibit, Netherlands-Hilton Hotel, Cincinnati.

9-11 Midwest Gas Association, annual meeting, Hotel Fort Des Moines, Des Moines.

11 Petroleum Equipment Suppliers Association, southwestern district, annual membership meeting, Shamrock Hilton Hotel, Houston.

13 American Institute of Chemical Engineers, Sabine area section; American Chemical Society, Texas-Louisiana Gulf section; sixth annual joint technical meeting, Lamar State College of Technology, Beaumont, Tex.

16-18 Western Petroleum Refiners Association, forty-seventh annual meeting, Hilton Hotel, San Antonio, Tex.

16-19 American Association of Petroleum Geologists, Society of Economic Paleontologists and Mineralogists, forty-fourth annual meeting, Memorial Auditorium, Dallas.

16-20 National Association of Corrosion Engineers, fifteenth annual conference, Hotel Sherman, Chicago.

17-18 Manufacturing Chemists' Association, air and water-pollution abatement conference, Netherlands Hilton Hotel, Cincinnati.

18 Petroleum Equipment Suppliers Association, eastern district, annual membership meeting, Duquesne Club, Pittsburgh.

19-20 New England Gas Association, annual meeting, Hotel Statler, Boston.

21 North Texas Oil and Gas Association, twenty-ninth annual meeting,

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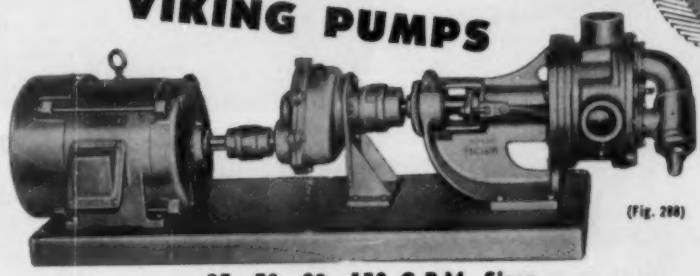

(Fig. 288)

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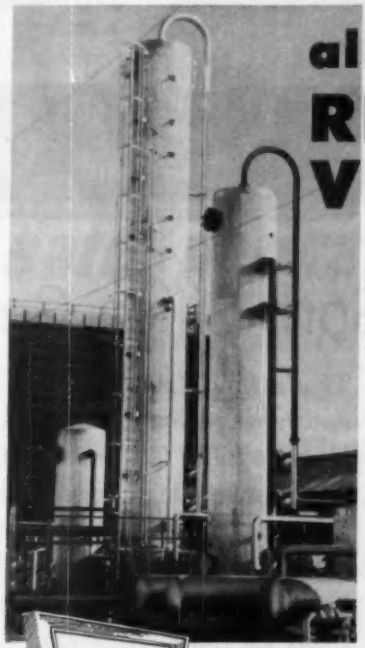

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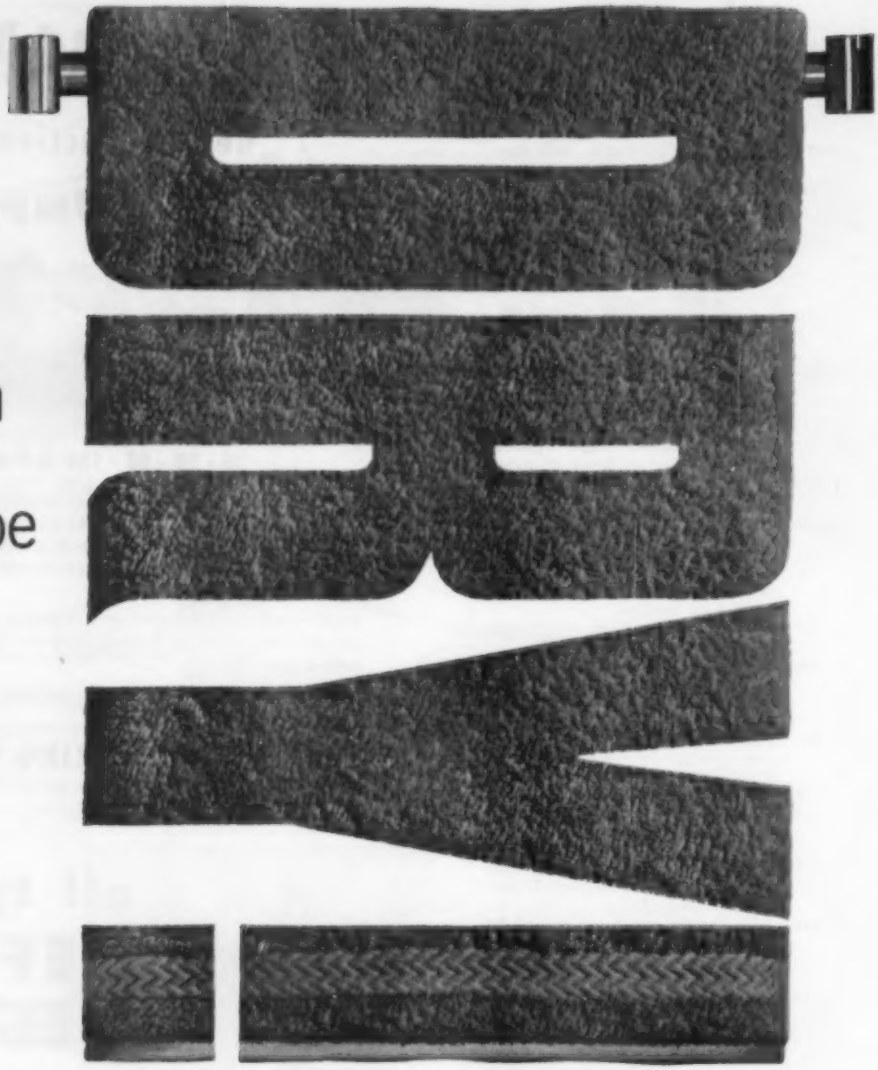

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Kemp Hotel, Wichita Falls, Tex.

23-24 University of Oklahoma, second conference on theory of fluid flow through porous media, Norman, Okla.

25-27 American Petroleum Institute, Division of Production, southern district meeting, Roosevelt Hotel, New Orleans.

31 Seventh annual meeting, Philadelphia-Wilmington section of American Institute of Chemical Engineers, and University of Pennsylvania, Philadelphia.

29-Apr. 2 American Society of Mechanical Engineers, instruments and regulators division conference, Case Institute of Technology, Cleveland.

APRIL

2-3 Society of Petroleum Engineers of AIME, Rocky Mountain petroleum section, Casper, Wyo.

2-3 American Institute of Mining, Metallurgical, and Petroleum Engineers, technical conference on stress corrosion, Mellon Institute, Pittsburgh.

2-6 Geological Society of America, Cordilleran section, annual meeting, University of Arizona campus, Tucson.

5-10 Engineers Joint Council, nuclear congress, Cleveland Auditorium, Cleveland.

5-10 American Chemical Society, national meeting, Boston.

6-7 Instrument Society of America, second national symposium on chemical and petroleum instrumentation, St. Louis.

7-8 Sixth Gas Compressor Institute, sponsored by University of Kansas and Southwest Kansas petroleum industry, Randall's Cafeteria, Liberal, Kans.

8-10 American Petroleum Institute, Division of Production, eastern district meeting, Penn-Sheraton Hotel, Pittsburgh.

14 Independent Oil Men's Association of New England, annual meeting, Hotel Statler, Boston.

14-16 Southwestern Gas Measurement Short Course, University of Oklahoma, Norman.

15-17 National Petroleum Association, semiannual meeting, Hotel Cleveland, Cleveland.

15-17 American Petroleum Institute, Division of Transportation, annual tanker conference, Jung Hotel, New Orleans.

16-17 Rocky Mountain Oil and Gas Association, midyear meeting, Casper, Wyo.

18-22 Petroleum Equipment Suppliers Association, twenty-fourth annual meeting, Boca Raton Hotel and Club, Boca Raton, Fla.

19-23 American Society of Mechanical Engineers, oil and gas power conference and exhibit, Shamrock-Hilton Hotel, Houston.

22-24 American Petroleum Institute, Division of Production, Mid-Continent district meeting, Herring Hotel, Amarillo, Tex.

22-24 Natural Gasoline Association of America, thirty-eighth annual convention, Baker and Adolphus Hotels, Dallas.

23-24 Sixth annual West Texas oil lifting short course, Texas Technological College, Lubbock, Tex.

24-25 Society of Economic Paleontologists and Mineralogists, Pacific Coast section, annual spring field trip, Boulder Creek area of Santa Cruz Mountains, California.

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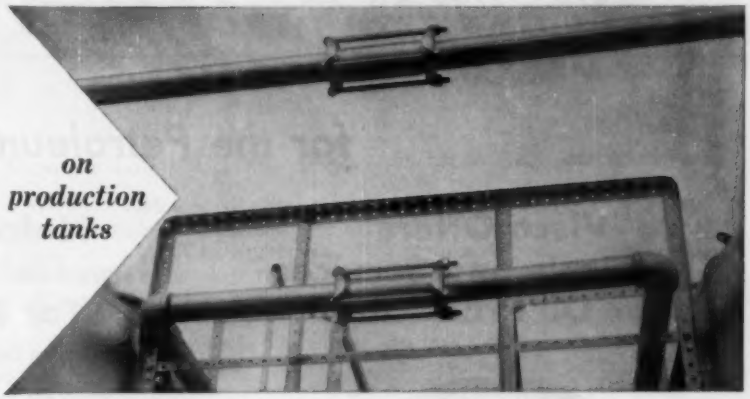

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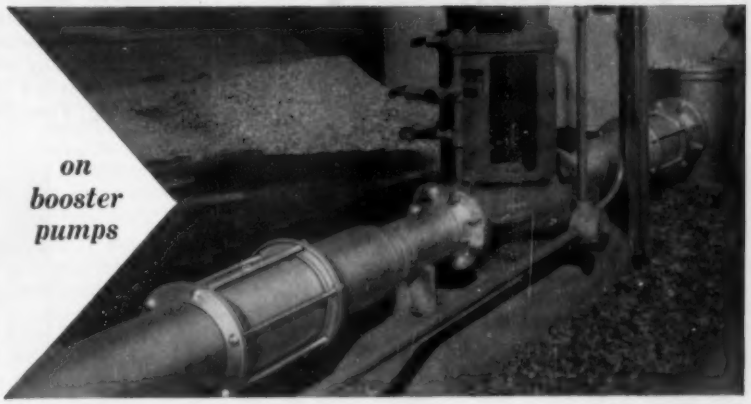

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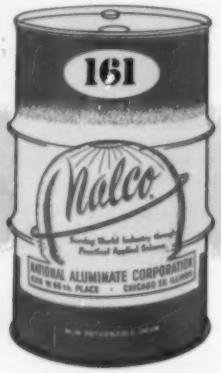

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TULSA, OKLAHOMA

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JOURNALLY SPEAKING

How to Louse Up the Show

OUT AT THE grounds of the International Petroleum Exposition here in Tulsa there is great activity as exhibitors prepare to get their booths and buildings in order.

This department began preparing for the Oil Show months ago. Our preparations consisted of clipping a piece from another magazine, writing on it "Use early in 1959," tossing it in our bottom drawer, and forgetting about it. The clipping accidentally came to light today, so now's a good time to use it.

It was a piece on how to louse up a trade exhibit, and with only a minimum of adaptation and a maximum of plagiarism we pass it on as advice to equipment and service companies planning to exhibit at the Oil Show. Here are the rules:

Let plans go until the last minute. The show doesn't open until May 14.

Hire a lot of pretty girls. They'll attract attention to themselves instead of to your exhibit.

Jam your booth with everything you make. It's just as important to sell old stuff as new.

Fill your booth with catalogs instead of equipment. People like to read, and besides this saves on freight.

Don't waste money on an elaborate display. The show only lasts 10 days.

Man your booth with trainees. They may learn something from the customers.

Keep your best salesmen in your hospitality suite downtown. They will entertain each other.

Don't have any moving displays in your exhibit. Good engineers will be able to figure out how your equipment works.

Don't publicize your exhibit. People who are really interested will find it.

Make people come inside to see what you have. Those who walk on past wouldn't be customers anyway.

Have your booth quiet and secluded. People at the show will appreciate a chance to rest.

There you have it—11 ways to louse up the Oil Show.

We're only kidding, folks. We know that any equipment house smart enough to take space in the IPE is smart enough not to fall into any of these traps.

But those firms showing for the first time may need a reminder about the last-minute rush hinted at in Rule 1.

For with something like 1,500 exhibitors all trying to get their displays in apple-pie order at the same time, there is a problem of logistics that would tax the ingenuity of the Quartermaster General of the Army. And no matter how carefully each individual plans, the last few days before the grand opening always present a scene of utmost confusion, with everybody getting in everybody else's way.

Just about all of Tulsa's carpenters, electricians, sign painters, bunting drapers, and other craftsmen are already dated up for that time, so extra help is hard to come by. And something always turns up missing so a vice president may have to dash around town in a taxi trying to pick up an extra extension cord or a box of thumbtacks.

There is a railroad spur into the show grounds, and half a dozen truck gates, but upwards of half a billion dollars' worth of equipment has to come in and much of it is big and heavy. This could create a king-sized traffic jam if everyone waited until the last minute.

Of course the big exhibitors don't wait. They would rather have their equipment tied up a week or two in the show grounds before the customers arrive than have it tied up in a traffic jam outside on opening day. So already, 4 months before opening, they have crews at work refurbishing their booths and working out the logistics of making all the pieces fall into their proper places at the right moment.

So the rest of you hundreds of thousands of oil-industry people who aren't exhibiting but want to come and see what's new in equipment can rest assured that everything will be in final readiness—well, almost everything—when the gates open for the first time, and that the Oil Show won't be loused up in any of the ways listed above. We hope.

—Henry D. Ralph

NOTHING SEALS LIKE THE *BAKER* "FLOATING" BALL

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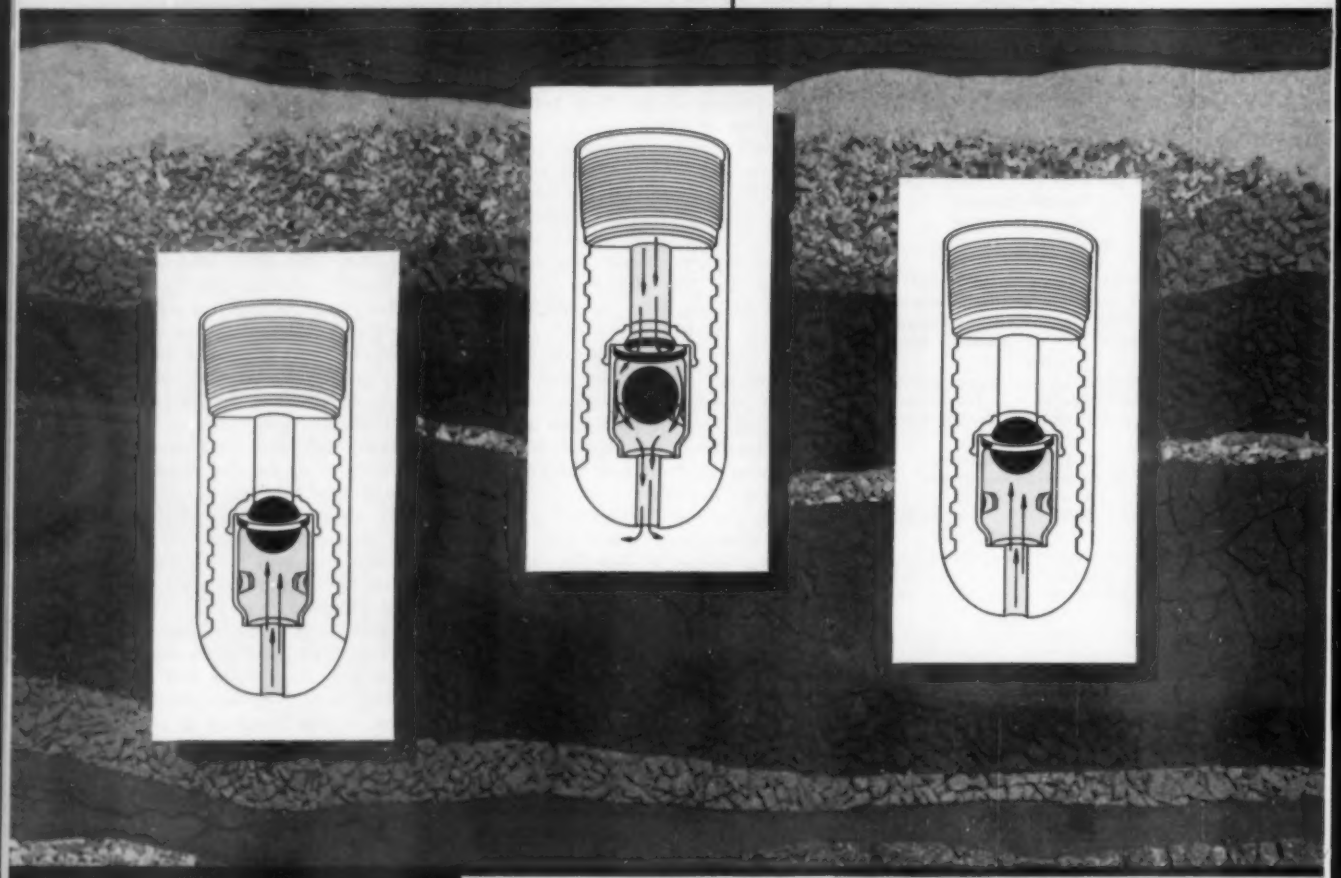

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The floating ball — in the securely anchored Bakelite cage — maintains a leak-proof back pressure seal against high- or low-pressure differential while the casing is "floated" down the hole. Note the absence of springs or guides to warp or stick and prevent a positive shut-off.

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A warning for Groundhog Day

TODAY, February 2, is Groundhog Day, and if refiners cast a shadow that predicts 6 more weeks of the kind of weather we have seen so far, the whole oil industry will be in for a very rugged spring.

The strong demand for heating oils brought high refinery runs and a slight increase in distillate yields (see page 151). But gasoline production increased disproportionately—in some recent weeks exceeding 50% of crude run.

If the rest of the winter brings a continuation of high runs and a high ratio of gasoline production—beware the Ides of March. Refiners will be stuck with a huge surplus of gasoline.

This can spell nothing but weak prices, distress selling, and more of the gasoline price wars that have been a major cause of the industry's poor earnings. The current year could be a reasonably good one if refiners don't ruin the prospect by getting gasoline stocks far out of balance with demand.

During the short period when a widespread refinery strike was a threat there may have been some justification for building up gasoline stocks. Today there is none whatever.

The latest week shows the highest runs in 18 months, though an encouraging shift toward higher distillate yields. There is room for a still greater shift away from gasoline output and a need for a tighter rein on runs and a closer check on inventory trends.

The tragedy is that a few leaders of the industry sound this same warning on stock levels every year about Groundhog Day, but refiners pay no more attention to it than the weather does to a groundhog.

A need for better understanding

THERE'S a remarkable story in the news section of this issue—an interview with local leaders of oil-workers' unions.

What these men think about conditions in the oil business shows that management has not succeeded in giving its employes a full and true understanding of the facts.

In all sincerity these union spokesmen voice impressions based on half-truths and superficial analyses.

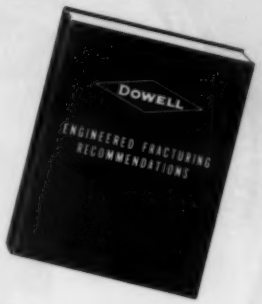
If this is a fair sample of the average oil worker's understanding of the industry—and it probably is above average—management has a big gap to bridge in the field of employe communications.

DOWELL ANNOUNCES

an important, new advance in oil and gas well fracturing

Dowell's New "Fracturing Guide" has increased success ratio of oil well fracturing treatments from less than 60% to 97%!

Dowell engineers, working closely with leading oil and gas producers, have now developed a revolutionary new technique for engineering fracturing treatments to yield optimum results.



More than 300 treatments using this new method have been made. They indicate that the success ratio of fracture treatments can be increased by more than 50 per cent.

This new system of designing well treatments is based on tables and graphs contained in a manual now in use by Dowell engineers. In preparing the manual, "Engineered Fracturing Recommendations," Dowell engineers consolidated and correlated industry-accepted calculations, reservoir data, frac fluid properties, and their own experience from thousands of treatments. The "Guide" has been equally effective on both old and new wells.

How is the "Guide" used?

First, your Dowell engineer needs a reasonable amount of information about your well. Then he uses the charts and formulas compiled in the manual to design a fracturing treatment to fit that particular well. The "Guide" helps you:

1. *To choose the proper fluid and additives to meet reservoir conditions.*
2. *To predict the fracture area created on any treatment.*
3. *To choose the proper treating volume on re-treatments.*
4. *To get high-capacity fractures on each treatment.*
5. *To reduce sandouts that are not planned.*
6. *To predict surface pressure conditions prior to job performance.*

Results have been a spectacular increase in the number of successful jobs. Benefits have included faster payout, lower lifting costs, high production and greater ultimate recovery because of *better decline curves.* Really *engineered* fracturing using the new "Guide" is available *only* from Dowell.

This extra service costs you nothing — yet the benefits have been nothing short of amazing. Call your nearest Dowell engineer for more information. Get him to *engineer* the treatment for your next well. In Canada, call Dowell of Canada, Ltd.; in Venezuela, United Oilwell Service. Dowell, Tulsa 1, Oklahoma.

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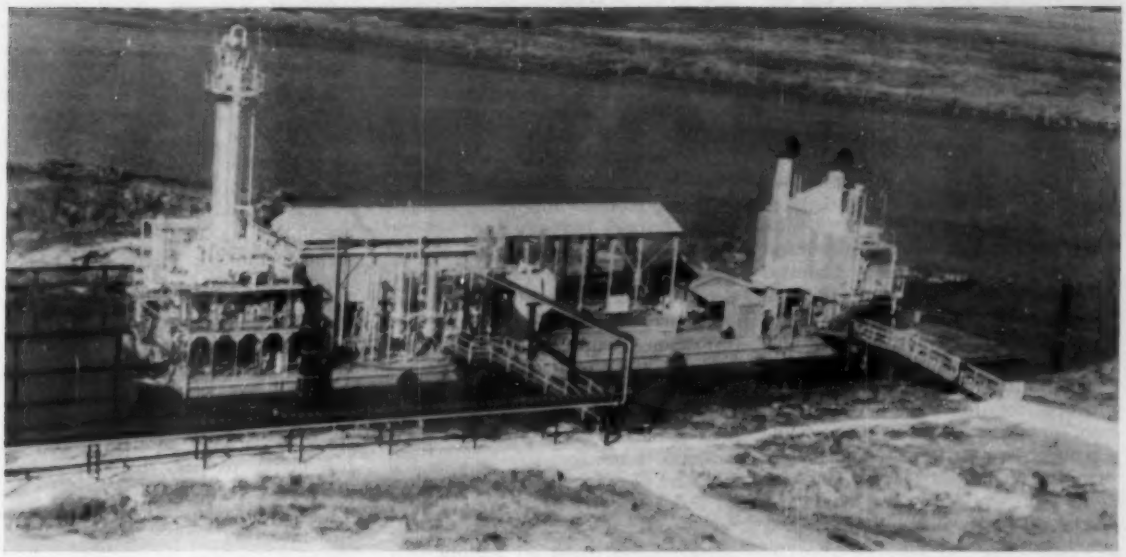


BARGE-MOUNTED liquefaction plant of Constock near Lake Charles, La., supplied the liquid cargo for historic voyage of Methane Pioneer. Such plants may have big future helping gas utilities meet peak demand.

Liquid Methane May Stage U. S. Boom

• Northeastern gas utilities are studying plans for liquefying pipeline gas and storing it for winter peak demand. This use may rival underground storage and get under way before foreign areas start burning liquid gas.

GLOWING prospects for the future of liquid natural gas so far have centered in its transoceanic movement to fuel-hungry foreign areas.

But actually promotions already have been started that may open up a vast field for liquefying U. S. pipeline gas in the summer and storing it for use in winter peak-demand periods.

Several gas utilities in the northeastern section of the country at least are studying the idea. Such a plan would involve building liquefaction plants and storage.

Other utilities serving areas near tidewater also are giving thought to the future possibility of buying liquid methane by tanker and storing it for peak-demand use.

Either possibility will be a by-product of the voyage of the Methane Pioneer. This former freighter converted into a tanker is due to arrive in England this month with the first cargo of liquefied natural gas for overseas shipment.

Gas executives have predicted for some time that successful voyages by the Methane Pioneer will prove one big point: The equipment and techniques are at hand to handle large shipments of liquid methane over long distances.

The result will be to open vast new markets in Western Europe and Asia for gas now going to waste in South America, Africa, and the Middle East.

But even before that occurs the other outlets for liquid natural gas may be created nearer at home. Back of this push is a new company, Constock-Pritchard Liquefaction Corp. It has been formed in New York to develop the design and construction of facilities for all phases of gas liquefaction.

The company is owned jointly by J. F. Pritchard & Co., Kansas City, Continental Oil Co., and Union Stock Yard & Transit Co., Chicago. The latter two firms also are partners in Constock Liquid Methane Corp., which is promoting Methane Pioneer venture with the British Gas Council.

A new look . . . Top business for liquefaction immediately will be in peak shaving.

Peak shaving is an old gas-utility practice in which standby sources of supply are used to meet peak-demand periods. Utilities in the past have met this unusual, temporary demand with interruptible sales, spare pipeline capacity, underground natural gas storage, or standby propane storage.

All have some particular disadvantage. Interruptible sales carry a low rate compared with firm gas sales. Liquid propane storage has physical and economic limitations. Spare pipeline capacity is a costly investment. Underground storage of natural gas has proved excellent where the storage fields are close enough to be effective and where conditions underground are ideal for natural gas.

Liquid natural gas storage, Con-

stock-Pritchard believes, can prove competitive in cost with underground storage in the future and has the advantage of offering a wider choice of locations.

For example, Columbia Gas System has $120 million invested in underground storage from which it can deliver 2,000 million cubic feet daily of gas.

Constock-Pritchard estimates that $16 million will build a basic liquefaction plant that will deliver 150 million cubic feet daily from storage of 1,600 million. This basic plant can be expanded at these increment costs: $7,000 per million cubic feet daily of vaporization delivery capacity and $650,000 per 100 million of storage.

These estimates indicate liquefied natural gas storage is competitive in cost with underground storage.

Gas utilities near ports may be able to purchase liquid methane for peak shaving if the Methane Pioneer project proves successful. Plans already have been drawn, and financing is being sought on a large gas-liquefaction plant in Venezuela. Liquid methane could be available on the world market in large volume within a few years.

Eastern utilities have shown an interest in the Constock-Pritchard process for building their own standby facilities. Eastern sources report that one New York utility has estimated it could add 300,000 new steady customers by shaving its winter-time peak demand with liquid methane. The shaved peaks provide the equivalent of an expanded system.

The economics . . . The real value in peak shaving lies in how much additional revenue can be made in increased firm sales.

Peak gas can cost many times its sales value and have little effect on the net return because it is produced only a few days a year. Consequently, storage represents the major portion of any plant investment for peak shaving.

Russell Young, a Constock-Pritchard vice president, in a recent address to the Society of Gas Lighting gave costs of using liquid methane for peak shaving compared with other methods.

He estimated that $5.4 million would buy facilities for liquefying 2 million cubic feet daily of natural gas and delivering 50 million daily from 300 million cubic feet of storage.

Total fixed costs on this plant were estimated at $778,000 with operating costs for each full day of sendout of $28,750. Thus a 1-day sendout period would cost $806,750. And 12 days' sendout, equal to 35% of peak shaving, would cost $1,123,000.

Young estimated that similar peak-demand deliveries of gas from a pipeline for the first day would cost an average of $2,440,000 and the 12-day cost would reach $2,605,000.

If peak deliveries were stepped up to 150 million cubic feet daily, liquefied natural gas facilities would cost $3,010,400 for 12 days' sendout, while pipeline contracts for the gas would cost the utility $7,815,000.

Advantage of using liquefied natural gas to meet peak demand stems from the high rates which pipelines charge utilities for the privilege of getting delivery on a sudden slug of gas on a peak-demand day.

Young reported this yearly demand charge ranges from $22 to $69 per thousand for a stated volume of peak gas. On top of this an average 30-cent per thousand commodity rate applies on actual volumes of peak gas used.

Reason for the high demand charge by pipelines is simple. The gas transmission companies have to build expensive transmission and storage facilities to handle this temporary rush of business. Rates for peak-demand supplies are computed to pay for the cost of this investment.

The minimum $22 per thousand demand rate is based on pipeline costs averaging $200,000 per million cubic feet daily of capacity. But current pipeline costs have increased to nearer $600,000 per million. This means in the near future the demand rate may jump still higher. This would make standby liquefaction facilities even more attractive to gas utilities.

A disaster . . . Use of a natural-gas liquefaction plant for meeting peak-demand days is not new. It was used successfully at Cleveland for several years.

Unfortunately, a disaster ended that venture and for a time stalled further growth of natural-gas liquefaction.

What happened at Cleveland? A new 90-million cubic feet storage tank ruptured and released its contents into unrestricted areas with open sewers. The resulting explosion took a heavy toll of lives and property.

Several investigations of the Cleveland blast determined that location was the prime fault there. The storage tank was placed on a knoll surrounded by a built-up residential area. The system of dikes or pits was not sufficient to hold the tank's contents, which seeped into the low-lying areas and open sewers.

Since then, however, advances have taken place in low-temperature equipment which give even greater safety margins. This experience has stemmed from the demand for liquid oxygen both for commercial purposes and for use in submarines and intercontinental missiles.

Constock also has amassed valuable economic and operating data on liquefaction plants, according to Young. He said a 6 to 8 million cubic foot liquefaction plant has been in operation since 1956. It will supply the cargo for the Methane Pioneer.

Similar data on liquid methane storage also is being provided by the Methane Pioneer venture. At both Constock's Lake Charles, La., terminal and at the British Gas Council's plant on the Thames River near London, storage to handle the liquid equivalent of 100 million cubic feet of methane has been installed.

The storage is provided by flat bottom, dome roofed, double-walled tanks operating at minus 259° F. and atmospheric pressure. Inner tanks are aluminum and outer tanks of carbon steel. There is a 3-ft. insulation space between them.

The Lake Charles tankage actually makes the eighth such installation that Chicago Bridge & Iron Co., has built since 1954. Most of them were built for liquid oxygen requiring minus 300° F. storage. Tanks on the Methane Pioneer were of similar construction.

Processes . . . Investigation by Constock-Pritchard of various liquefaction processes shows the two most preferred are the expander cycle or the cascade cycle.

The expander cycle is the simpler of the two, according to Constock-Pritchard, and is more economical in small plants. In this process, natural gas is compressed to 1,500 psi. Then it is taken through progressive gas to gas heat exchange against about twice its volume of cold recycle natural gas. This cools the natural gas below its liquefaction temperature and reduces the pressure by stages to the storage pressure. The recycle gas is recompressed to 1,500 psi., cooled, and bled through an expander engine where it chills to minus 190° F. Then it is ready for heat exchanging against the liquefying stream.

The cascade cycle is nearly the same as the expander methane refrigeration cycle except that in larger plants other refrigerants are substituted. Propane may be used down to minus 40° F., ethane down to minus 120° F., and final subcooling by methane heat exchange and recycle as it is flashed to the storage pressure.

At its liquefaction temperature, the volume of the natural gas is 1/600 of normal and with care can be stored or transported.

And in both these areas the Methane Pioneer project is furnishing operating data that will have worldwide significance.

What Labor Wants From Management

JOURNAL Editor John P. O'Donnell sat in on an important labor meeting last week.

It was a meeting of the steering committee of a new council of oil-industry workers in the metropolitan New York area. The council is now in the process of formation. It is believed to be without precedent in the oil industry.

Its object: To coordinate the efforts of all oil-industry locals in the area, without regard to their affiliation. Now on the steering committee are representatives of the AFL's Operating Engineers, the Oil Chemical & Atomic Workers Union, and independent oil unions.

At the conclusion of the meeting O'Donnell posed the 11 questions below. The answers obviously do not represent the views of each member, but they were voiced by one or more and approved by the entire steering committee. The Journal believes them important. They show a cross-section of union thinking, and they demonstrate a significant gap between management understanding and employe understanding of oil's economics.

JOHN P. O'DONNELL
District Editor

Q: What do you want most from your company?

A: Job security. We want continuous employment with satisfactory wages and respectable treatment. We are particularly interested in the maintenance of rates for senior employes.

Q: What do you think of your "fringe" benefits?

A: Good. There is a lot of room for improvement, especially in the direction of hospitalization. We think that better plans could be established insofar as senior citizens are concerned.

Companies should get union help in working out plans. The council endorses the O'Leary home-care plan (OGJ, Sept. 23, 1957, p. 72). Pension plans could be improved by combining age and service factors similar to civil service practice.

Q: Do you think a wage increase now is justified?

A: Definitely, because of an increase in productivity and in the cost of living, the industry can afford it and it will not work any hardship.

Q: What do you think of crossing craft lines?

A: It is contrary to the needs of the times when the need is for skilled mechanics. It's like going to a surgeon and telling him to put away his scalpel and go into general practice. It destroys a worker's incentive along the line he's best qualified.

Q: What do you think of automation?

A: It's here to stay and we have to learn to live with it. Both wage earners and consumers should benefit through higher wages and lower prices. It should mean a shorter work week, for otherwise it would eliminate too many jobs.

Q: What do you think of contract maintenance?

A: We are against it in principle. If men are available in the plant they should be used. We believe that the work normally done in the industry should be done by employes. There is a safety factor involved. If one bad accident occurred there wouldn't be enough men to handle it. It takes 10 years for a man to learn the hazards of his job.

Q: What do you think of the oil industry?

A: It's a great industry that has contributed a lot to the country. But a lot of things should be changed. Legislative changes are needed, including the elimination of the depletion allowance on foreign operations. It is unfair to the public. The companies make a lot of money on which they pay no tax.

We feel the company has a moral obligation to keep up the standard of the worker and his family. Ten years ago oil was above all industries, but in the meantime they have caught up and oil has not advanced in proportion.

Q: What do you think is oil's biggest problem?

A: Atomic energy. In 20 years it could cost many jobs, though petrochemicals may absorb some.

Q: Do oil companies make money on refining?

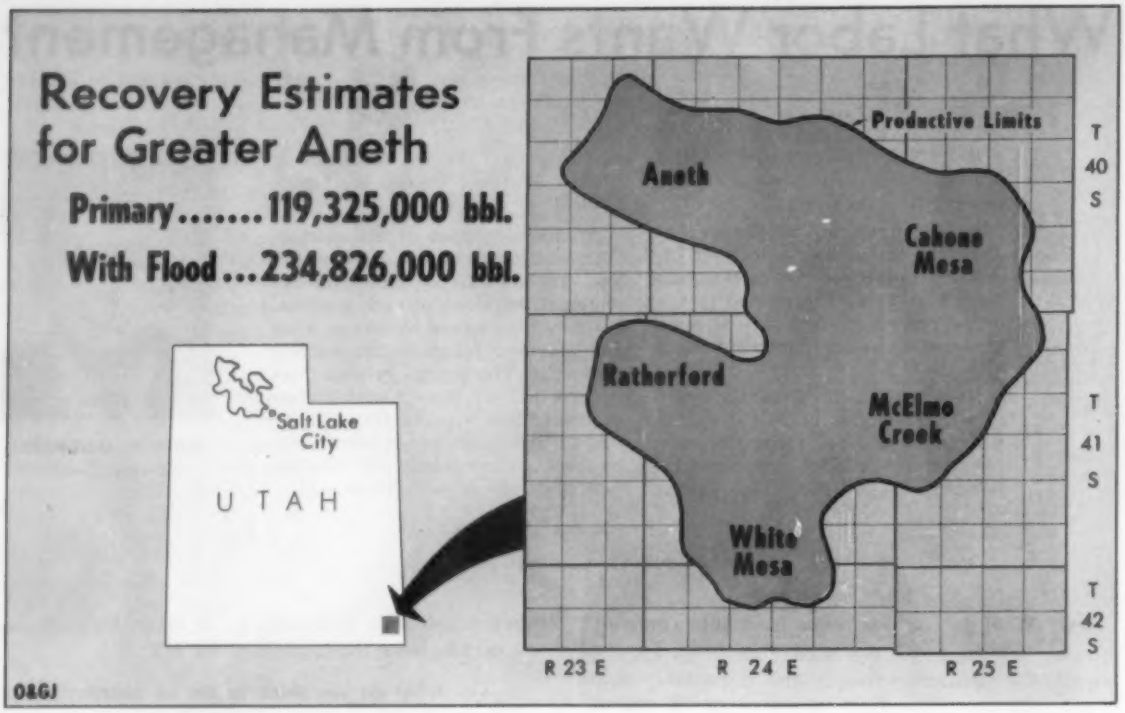
A: Not as much as they'd like, but it is close to the top money maker. Distribution is the most expensive, and the cheapest is drilling.

Q: What factors do you consider in asking for wage increases?

A: Productivity, cost of living, and improvement of conditions. Automation requires more knowledge and puts more strain on a man, but it results in greater output per man.

Q: Do you think it would be possible to work out a formula tied to profits and productivity that would permanently solve labor-management wage issues?

A: No, there are too many variables. Coal, once a dying but now improving industry, has come close to it. The only possibility would depend on the ability of labor and management to look at over-all society and determine labor's fair share as well as the stockholders.



Aneth Area Recovery Outlook Poor

• Engineering report for Utah commission pegs primary recovery at less than 15%. Water flooding would brighten the picture a bit, but it still would leave more than two-thirds of the oil untapped.

THE GREATER ANETH area of the Four Corners has a whopping store of oil in place—but more than 70% of it is going to remain in the ground even with secondary recovery.

This is one of the findings of an engineering report completed last week for the Utah Oil and Conservation Commission on the most exciting oil field found in this country in recent years.

The study was made for the commission by Core Laboratories, Inc., Dallas.

Core Lab was hired by the commission to study the Greater Aneth area, including Aneth, Ratherford, Cahone Mesa, White Mesa, and McElmo Creek fields, and determine whether:

... **A volumetric gas limit** for each well in the area would be feasible as a conservation tool.

... **A gas-oil ratio rule** is advisable as a gage for unreasonable or excessive waste.

... **Secondary recovery prospects** have been or are being affected by present operations in the field, and when such projects should be started.

The five fields included in "Greater Aneth area" now are generally conceded to make up one huge reservoir.

The proved productive area now sprawls over more than 55,000 acres. It boasts about 380 wells, with room for a theoretical 600 if every 80-acre location were drilled. Best estimates are that the present proved area will have somewhere around 500 wells when completely developed.

Study results . . . The Core Lab report on the big reservoir shows what most suspected—that it certainly is no East Texas or Kelly-Snyder.

As a reservoir, it's performance will be relatively poor.

Core Lab estimates original oil in place in the pool as now defined at 833,856,000 bbl.

At abandonment in about 15 years, primary recovery operations will account for only 14.31% of this volume or 119,325,000 bbl.

The huge field already had produced nearly 23,000,000 bbl. of this at the first of the year from the 100-200-ft. thick Desert Creek zone of the Paradox formation.

Secondary prospects . . . A gas-injection program would do little to increase recovery, the report finds. Even by returning 70% of produced gas, operators could hike pool recovery only another 2.07% to 16.38% of that originally in place.

A water flood, however, would be a different story.

If started at the right time, Core Lab said, a flood would double primary recovery—boosting total take to about 28.2%, or 234,826,000 bbl. Concurrent injection of 70% of produced gas would raise total recovery slightly—about 1.4% to a total take of 29.7%.

The ideal time to flood from a recovery standpoint only, the report finds, is when pool pressure has fallen to roughly 1,100 psi.

Recovery variation would be practically insignificant, however, within a pressure range of 900 to 1,200 psi. Below this pressure range, flood recovery would fall off due to shrinking of residual oil and increasing mobility ratio between crude and water. Above it, flooding would not be as desirable because the reservoir's pri-

mary producing mechanism would become much more efficient as pressure drops below the saturation level.

Time limited . . . Reservoir pressure in the Greater Aneth area is falling fast.

Average pressure was calculated at 1,948 psi. in March 1958. In November, it was down to 1,445 psi.

Actually, Core Lab feels the 1,445 psi. reading is somewhat misleading in that it doesn't take into consideration parts of the area where pressures are certain to be higher.

The true average field-wide pressure, it thinks, is probably closer to 1,600 psi. In any case, field pressure already has fallen below the saturation level, fixed by Core Lab as about 1,722 psi.

At the big field's present producing rate of about 70,000 bbl. daily, pressure will have fallen to the optimum flood level in another 3 to 3½ years, Core thinks. This gives the operators time, but probably with little to spare, to get some form of secondary recovery under way—either through a voluntary unit or cooperative projects.

Actually, operators already are studying unitization possibilities. Prime mover is the Southeast Utah Engineering Committee, a group formed by the Greater Aneth operators. The Texas Co., as the largest producer in the area, is committee operator. And it would most likely be the operator of a unit if one is formed.

Deferring a flood to abandonment pressure of about 200 psi., the Core report says, would cost the Aneth operators about 7.1% of recoverable oil or about 16,200,000 bbl.

The Dallas consulting firm pointed out that its recommended starting time for a flood is based on maximum oil recovery and not maximum economic recovery. An investigation of economic factors, it said, was outside the scope of the study.

It said, however, that the optimum economic recovery from a flood might be found at a pressure level above the 900-1,200 psi. range. If so, this would give Aneth operators even more cause for haste in getting started.

Other findings . . . Core Lab advised the Utah commission in its report that both volumetric gas limits and flexible gas-oil ratio rules should be helpful in preventing waste and conserving reservoir energy in the Greater Aneth area.

The volumetric gas limit, it said, would accomplish much the same objective as restricting oil-producing rates. Each would slow the pressure drop and gain time, if needed, to get water flooding under way.

A good gas-oil ratio rule, the report said, would complement the gas limit by preventing excess spending of reservoir energy without the production of an appropriate amount of oil.

Gas limit in use . . . Actually, the Utah commission already has a volumetric gas limit in effect in the Greater Aneth area.

Wells in the reservoir have not been permitted to produce full blast since shut in by order of the federal Government several months ago to stop gas flaring.

Following completion of gas outlets, the commission ordered a gas limit into effect in late December which will cut back oil production to some extent.

Whether this setup will remain in force will be determined at hearings the commission will call following its analysis of the engineering report on the field.

Area booming . . . Meanwhile, Greater Aneth continues as one of the most active drilling and development areas in the country.

One company, for instance, plans to drill between 30 and 35 more wells in the big field within the next few months.

And there is no real evidence yet that the field has been defined. Dry holes at Aneth are no real proof in that they may be due to erratic porosity pinchouts or sometimes improper completion.

Some geologists feel that the new Bluff Unit producing area to the northwest of Aneth will prove to be a part of the huge reef-type strat trap with further drilling.

New Imports Study Launched

. . . by cabinet group. Results may determine control plan to be put into effect for both foreign crude, products.

THE CABINET Fuels Committee is taking another approach to the oil-imports problem to clear legal objections to new controls.

At the insistence of two cabinet members, a new investigation is being made to determine again whether oil imports are a threat to the national security.

The investigation was announced last week by Leo A. Hoegh, director, Office of Civil and Defense Mobilization. New OCDM regulations allow up to 25 days from that date for the filing of data and rebuttal material to be considered in the investigation.

Voluntary imports controls, recently extended 2 months, are now scheduled to expire February 28, 6 days after the OCDM deadline. There are indications that OCDM plans to move fast in the new investigation. (See p. 60 for December imports figures.)

The 25-day time limit applies to investigations requested by the head of a government department or agency. It went into effect the same day the requested investigation was announced.

Hoegh said the investigation was requested by Sec. of State John Foster Dulles and Sec. of Defense Neil McElroy. Both Dulles and McElroy are members of the fuels committee, which serves as adviser to the President.

Products included . . . The investigation will cover not only foreign crude oil, but also its "derivatives and products."

If it finds that all such imports are excessive as far as national security is concerned, it could clear the way for broader and more stringent controls than any previously recommended by the cabinet committee.

But a finding that oil imports are not now a threat to the national security would wreck the whole program. Under the trade agreements extension act, the President can curb imports only if they are found to constitute a security threat.

Present controls are based on a certification issued in April 1957 by Gordon Gray, then director of the Office of Defense Mobilization.

At that time, Gray reported to the President that he had reason to believe crude oil was being imported in such quantities as to threaten to impair the national security. The report did not cover products.

The next year, in May 1958, Gray sanctioned controls on products imports because they were considered a threat to the voluntary program governing crude oil.

Since then, OCDM has succeeded ODM, and Hoegh has succeeded Gray.

There have been reports circulating in Washington that the Justice Department had raised the question regarding the current threat of crude and products to the national security.

Close advisers to the cabinet committee intimated the new certification was intended to speed development of stronger import controls by resolving objections raised by various departments.

Crafts Are Issue

. . . in Gulf strike at Port Arthur. Company standing pat against rigid maintenance rules "which waste manpower."

GULF OIL CORP.'S giant Port Arthur refinery was closed by a locally called strike of the Oil, Chemical and Atomic Workers Union last week on the single issue of classifying workers.

Whether other refineries and crude production in Texas will be affected by the Port Arthur shutdown depends on the length of the strike.

The Port Arthur strike was called as the 5% wage increase was spreading generally throughout the industry. It came, too, as some were calculating the higher costs and predicting abandonment of many marginal oil wells, with a resulting cut in the nation's reserves.

The Gulf issue . . . Both labor and management at Gulf agreed on the 5% wage increase.

But Gulf wants the contract to provide that classified workers, under certain conditions, be allowed to perform certain other duties incidental to their job. The company says, however, it is not attempting to abolish craft lines.

The union, countering this, offered to renew the old contract without change, except for the wage increase.

Gulf is expected to defend its demand for a reclassification clause in the contract on the grounds that rigid craft-line requirements waste manpower and at times reach a point of absurdity.

It is known that Gulf wants to clear up vague language in the contract so that it would not be necessary to call in craft specialists at the refinery for routine work that other workers on hand could do.

Reclassification is also an issue in negotiations between Humble Oil & Refining Co.'s Baytown plant and the Baytown Employes Federation, an independent union. It was understood Humble seeks a refinery mechanic classification that would give a worker the right to do a number of jobs under certain conditions. Craft lines would still be maintained generally.

The effect . . . The Port Arthur refinery has a throughput of about 275,000 bbl. of crude daily and a work force of 4,500 persons.

The shutdown may affect other plants which depend on Gulf's Port Arthur refinery, but whether they would be forced to close down is doubtful at this stage.

A number of plants get ethylene from Gulf, but a 30-day supply is on hand.

Labor picture . . . Elsewhere the 5% wage increase was spreading throughout the industry, although final settlement is being delayed at some plants by other issues.

With both labor and management agreed on the wage hike, negotiations still were under way at some plants over such questions as duration of contracts and proposed wage freezes.

The 5% pattern also spread through the Canadian oil industry. The OCAW Canadian district council endorsed settlements on this pattern.

Who gets hurt . . . The wage increase will have the effect of reducing the nation's oil reserves.

Paul R. Schultz, president of the Oklahoma Independent Petroleum Association, says, for example, the higher operating costs will force abandonment of some marginal wells that otherwise would have produced for some time. Just how much oil will be lost can't be determined.

In Oklahoma Schultz pegs the present average lifting cost of oil at about 75 cents a barrel, with 60% (45 cents) of that direct labor costs. The 5% increase adds 2¼ cents a barrel to that average. This doesn't include expected higher charges by service companies which followed the wage pattern.

But with marginal wells operating costs run as high as $2.75 per barrel, and 80% ($2.20) of that is labor cost. The 5% boost then means an extra 11 cents per barrel out of the producer's pocket.

It runs the operating cost up to $2.86 per barrel, with the average crude price in Oklahoma now just under $3 a barrel.

"Wells such as these will get knocked out because they will become uneconomical," Schultz says.

Schultz says the only way the producers can offset the higher operating costs is to "come up with a better economic base—find some economies."

Alberta Gas System to Grow

A 2-YEAR EXPANSION program, costing at least $39,000,000, is planned by Alberta Trunk Line Co.

The big expansion plans are based on growing requirements of Trans-Canada Pipe Lines, Ltd., and export lines to the U. S., proposed by Westcoast Transmission Co., Ltd., and Alberta & Southern Gas Co., Ltd.

The Alberta Trunk Line timetable this year calls for 122 miles of 30-in. main line to Torrington from the northern end of the present main line near Princess. Laterals would be built from this line to Carstairs, Nevis, Wayne, Hussar, and Makepeace fields.

In 1960, the company plans to extend the main line 70 miles north from Torrington to Dick Lake. Laterals would connect Kessler, Gilby, Duchess, and Sylvan Lake fields.

Oil Deal Planned

by Detroit company. Nafco to buy properties in 12 states.

NAFCO Oil & Gas, Inc., a subsidiary of National Automotive Fibers, Inc., plans to pay $19 million for the oil and gas properties and other assets of Oil & Gas Property Management, Inc., of Texas and New York.

Nafco also will acquire 50% of the stock of Dorchester Corp., subsidiary of Oil & Gas Property Management.

The transaction, still to be made final, is the first step to diversify the activities of National Automotive Fibers, a Detroit automobile supplier.

Properties to be acquired include net production of 4,200 bbl. of oil and 25,000 M.c.f. of gas daily from fields in 12 states. The principal production is in Texas, in Old Ocean, East Texas, SACROC, and Conroe fields.

Dorchester Corp. owns and operates three natural-gasoline plants and 241 gas wells in the Panhandle and Hugoton fields of Texas, Oklahoma, and Kansas. The plants process 160,000 M.c.f. of gas and produce 4,000 bbl. of light products daily.

Alberta Nominations Rise

NOMINATIONS for Alberta crude continue to climb, with purchasers asking for 413,660 bbl. daily during February.

This is the highest level since mid-1957. Since then, demand has held generally below the 400,000-bbl. mark, dropping to below 280,000 bbl. daily last spring.

The February bids are 10,000 bbl. higher than last month, and more than 46,000 bbl. higher than the same month last year.

U. S. refiners requested 43,200 bbl. daily. This is 3,800 bbl. higher than

requests last month. Biggest U. S. purchaser is General Petroleum Corp., Ferndale, Wash., which will take 23,900 bbl. daily.

Other U. S. bids include International Refineries, Inc., Wrenshall, Minn., 7,100 bbl. daily; Bay Refining Corp., Bay City, Mich., 6,500 bbl.; Lake Superior Refining Co., Superior, Wis., 5,000 bbl.; and West Branch Refineries, Inc., West Branch, Mich., 700 bbl.

No Jab Intended

at regulatory bodies, says Decker. Spacing drive is aimed at new pools, not old.

THE TEXAS subcommittee of the Oil Industry Conservation Forum acted last week in Dallas to clear up confusion over its aims and methods in a drive for wider well spacing.

Harold Decker, chairman of the Texas subcommittee, termed it "unfortunate that misconceptions have arisen as to the group and its objectives. Some have taken our efforts as critical of the Texas Railroad Commission, and that's just not so."

Decker made his statement following a subcommittee meeting in Dallas. It was believed prompted in part by a recent statement by E. O. Thompson, senior member of the commission, in Houston.

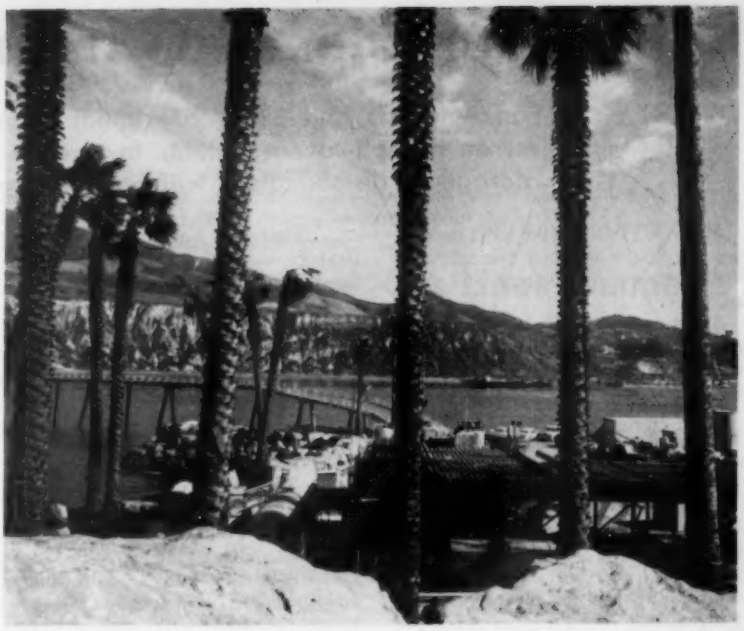
Speaking before the Gulf Coast section of the Society of Petroleum Engineers, AIME, Thompson said he thought it unfair "in the new drive for wider spacing to point the finger of scorn at regulatory bodies when it is the operators who drill the wells" (OGJ, Jan. 26, p. 106).

Broader spacing could be achieved, he said, if operators set spacing patterns in a field from the date of discovery of a new field.

Decker said in Dallas that the subcommittee "does not intend to suggest any change in rules or regulations for fields already developed or being developed.

Its sole purpose, he said, is to study further improvements which might be necessary in well-spacing and allowable practices under existing conservation laws. Conclusions drawn from this study will be furnished to the industry and the railroad commission, Decker said.

The industry, the Texas chairman said, must assume its rightful part in management planning to provide help to the commission in order that unsound practices may be avoided in future competitive operations.



Palm Trees Go Up on Drilling Island

HORTICULTURE is playing an important part in a drilling program off California's coast.

Gardeners have been busy planting waving palm trees on Richfield Oil Corp.'s drilling island off Rincon. The plantings are part of a site beautification program agreed on by Richfield when the 1,175-acre lease was awarded several years ago. About 1 acre of land is above water and is being beautified.

The island was built in about 45 ft. of water. It is 3,000 ft. offshore, but is connected to the shore by a causeway. The island's sixth well is being drilled. The island can handle 68 wells.

Wider Spacing Turned Down

. . . by Mississippi oil board, leaving 40-320 formula in effect. Oil firms made unsuccessful pitch for changes.

OIL COMPANIES have lost their battle for wider spacing of deep wells in Mississippi.

The Mississippi Oil and Gas Board, following a 2-day hearing at Jackson, decided against amending the present state-wide spacing rule of 40 acres for oil wells and 320 acres for gas wells.

Representatives of three oil companies, backed up by statements from several others, testified in favor of the change. The board reached its decision without even hearing the arguments from the opposition, principally royalty owners and officials of counties.

Spokesmen for Larco Drilling Co. and Humble Oil & Refining Co. and a Jackson independent operator and geologist had maintained drilling fewer wells would:

. . . **Adequately drain** reservoirs.

. . . **Liberate more capital** to be used in exploratory drilling.

. . . **Develop marginal** reserves being ignored under the current rule.

The board, in declining to double the present formula for wells deeper than 10,000 ft., concluded the testimony presented was "hypothetical."

Some consolation . . . Following the ruling, a board official said that the oil companies did not suffer a complete loss.

H. M. Morse, board director, said, "The testimony for it was not sufficient to cause the board to draw an order granting larger drilling units on a state-wide basis. The board did point out, however, that where necessary and proper proof is given, it is possible to obtain wider spacing under certain conditions. No formula was set down."

Patent Suit Has LPG Industry Edgy

• Pan American and Skelly are initial targets in Sid Richardson effort to collect on his salt-cavern patent. Involved is the basic process of leaching out storage by dissolving salt with water. Royalty asked: ⅛-cent per gallon.

EXECUTIVES in the LPG industry are keeping a nervous eye on U. S. district courts in Lubbock and Amarillo.

In these two halls of justice two suits are pending which, if successful, could tack millions of dollars on the industry's cost of storing LPG.

The suits were filed by Sid W. Richardson, Fort Worth independent, against Pan American Petroleum Corp. and Skelly Oil Co.

Richardson asks injunctions against withdrawal of LPG from storage in Hockley and Carson counties and a maximum recovery of triple actual damages as result of alleged patent infringements.

He accuses the companies of violating patents covering conventional methods of creating caverns in salt deposits. The patents cover storage of LPG, natural gas, or any other product in a salt cavern "formed by dissolving the salt with water and removing the so formed brine."

First of the patents was issued in 1951. It was acquired by Richardson and a revised patent, pinpointing the salt cavern process, was reissued to him in May 1957.

The suits allege:

. . . **That Pan Am** and Skelly since 1951 have been storing LPG in salt caverns in Hockley and Carson counties, Texas, in direct violation of the patents.

. . . **That both companies** were represented at a demonstration of the methods, covered in the patents, in August 1950.

. . . **That licenses were offered** to the companies to operate such storage, under the Richardson patents, and were declined.

In separate answers, the companies attacked validity of the patent issuance, claiming the methods of salt storage described are not patentable. One attorney countered with "storing things in holes in the ground is as old as man."

The Pan Am answer claimed that subject matter of the patents is covered in full or in part in 10 previous U. S. licenses and in one French, one Swedish, and two German patents. These date back to 1883. A German patent of 1919 and an American patent, issued in 1934, were referred to in Richardson's file when his patent was issued.

The Pan American suit was filed in Lubbock and the Skelly suit in Amarillo. Both are in the northern federal district of Texas. No action has been taken by the court to set cases for trial.

What it means . . . Of 42½ million barrels of LPG underground storage capacity in the U. S., 36 million bbl. capacity is in salt domes and salt layers.

More than 500 million gallons of LPG was withdrawn from storage last year, and the volume is increasing.

Pan Am and Skelly attorneys say that contracts submitted to them in Tulsa by Richardson representatives on the day the suits were filed provided for a license fee of ⅛-cent for each gallon of product withdrawn.

Based on such royalty charge, annual payments in fees by the more than 50 companies using LPG storage could exceed $600,000 a year. Should retroactive fees be figured to 1951, these would total millions of dollars.

Many interested . . . Pan American has three salt caverns in Hockley county with 159,000 bbl. propane and 28,000 bbl. butane capacity.

Skelly has five salt caverns in Carson county with capacity of 235,000

United States Patent Office

Re. 24,318
Reissued May 14, 1957

1

24,318

METHOD OF STORING GASES OR LIQUIDS

Reginald L. Pattinson, Aylmer, Ontario, Canada, assignor, by mesne assignments, to Sid W. Richardson, Fort Worth, Tex.

No Drawing. Original No. 2,590,066, dated March 18, 1952, Serial No. 602,411, June 29, 1945. Application for reissue June 3, 1954, Serial No. 434,355. In Canada June 30, 1944

6 Claims. (Cl. 61—.5)

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

This invention relates to the storage of gases or liquids.

The difficulties relative to the provision of storage facilities for natural or manufactured gas for heating purposes are well recognized and have resulted in the curtailment of the [use] of such gas for heating purposes.

2

evaporation is avoided. Gas so stored may be delivered to users at faster and more uniform rates than under present arrangements for natural gas, and without heating or other treatment of the gas. This overcomes one of the major difficulties in the use of natural gas.

The gas from a natural gas well or from a gas manufacturing plant is pumped into such underground cavities, located at desired or convenient points for storage and distribution and maintained under desired pressure having regard to distribution requirements. Its release for distribution is controlled by any suitable pressure regulating means.

While the invention has particular reference to the storage of heating gas, it will be understood that oil and other liquids, which do not dissolve the salt, may also be stored in the chambers described.

What is claimed is:

1. A method of storing fluids which comprises feeding the fluid to be stored into a preformed substantially impervious cavity in a natural rock salt bed beneath the surface of the earth *formed by dissolving the salt with water and removing the so formed brine*, said fluid being of such natur[e] that it is [essential] unaffected by the

THIS PATENT, issued 20 months ago, is the crux of a court drive to collect license fees on LPG withdrawals.

bbl. of propane and 148,000 bbl. of butane.

While Pan American and Skelly are the operators, other companies have interests in these operations.

These include: Tidewater, Magnolia, Honolulu Oil, Texaco, Atlantic, Sun Oil, Warren Petroleum, Midwest Oil, Sunray Mid-Continent, Kewanee Oil, Maracaibo Oil Exploration, Superior Oil, and Donnell Drilling. They are not named as parties in the suits.

Effects far-reaching . . . The booming LPG industry has found its greatest period of growth during years mentioned in the Richardson cases—since the 1951 patent.

Storage in the U. S. has zoomed from 9 million barrels in 1954 to 42½ million barrels in 1958 (OGJ Sept. 29, 1958, p. 40).

Total LPG sales in 1959 are expected to reach 7,591,400,000 gal., up 9.4% over last year.

How it started . . . The original patent application was filed June 29, 1945, by Reginald L. Pattinson of Aylmer, Ont. The patent (Letters Patent of the U. S. No. 2,590,066) was granted Pattinson March 18, 1952.

Pattinson assigned his title to the patent to Richardson on June 3, 1954. Richardson filed a request with the patent office for a reissue of the patent. Reissue Patent No. 24,318 was granted following a suit in the U. S. District Court for District of Columbia.

The court held that claims in the patent request did involve invention and were patentable. It overruled the patent office and its board of appeals.

The reissue patent, approved May 14, 1957, specifically emphasized the salt-cavern method of providing storage space.

The suits tell of a demonstration of the invention, held for the oil industry and the U. S. armed services in August, 1950. It was conducted near Kermit, Texas.

Richardson says licenses were tendered the two companies "on reasonable terms to practice the invention" and were refused. His petitions claim the companies within one year after the demonstration began storing fluid hydrocarbons on a "wholesa'e scale" in direct infringement of the patents.

He charges they not only are operating in violation of the patent requirements in the two counties "but elsewhere in the U. S."

Claims attacked . . . In its answer, Skelly said it was offered a license but before it had opportunity to accept or reject it, the suit was filed. Pan Am also denied it refused to accept "any license on reasonable terms."

Pan Am further charged that Richardson, in applying for the 1957 reissue patent, "misrepresented the nature and character of the alleged invention."

Bureau of Mines reports show that in September 1957 there were 777 million gallons of LPG in storage in the U. S. This dropped to 224 million gallons in February 1958, showing withdrawals in excess of 550 million gallons during the winter.

Impact of the cases on the whole LPG operation has been heightened by fact that one court—in the District of Columbia—already has upheld the patent.

Canadians Assured

government doesn't have to follow Borden suggestions.

PRIME MINISTER John Diefenbaker has made it clear that his government is not bound to carry out all or any of the recommendations of the Borden Commission.

The commission's interim report on Canada's oil and gas industries brought a barrage of unfavorable comment from both within and outside the industry.

A number of oil men feared many of the commission's recommendations, if adopted, would have extreme effects.

The prime minister, in the speech from the throne which opened the latest session of Parliament, said he plans to set up a national energy board, as recommended by the commission. But, he added, that does not mean that all recommendations of the commission—which he set up—will be carried out if the government thinks they would be in any way detrimental.

"I want to make it perfectly clear at this time, relative to the various recommendations in the Borden Commission report, we will deal with these questions when those particular matters come before the House in the form of a bill," he said.

Court Rules Against Railroad

THE FEDERAL Government has dealt itself in for a share of oil produced from a section of Wyoming land by Continental Oil Co.

Judge Ewing T. Kerr in U. S. District Court at Cheyenne upheld the Government in its suit against Conoco and Northern Pacific Railroad over ownership of a 30-acre strip included in the 640 acres in Park County leased by Conoco from the railroad. Conoco has produced more than 1,500,000 bbl. of oil from one section of the land.

Kerr ruled that in 1916 the railroad deeded title and minerals of the 30-acre tract to the federal Government. Northern Pacific said it intended only to convey right-of-way for an irrigation ditch.

Gas Lines Planned

to tap South Texas reserves for shipment to California.

TWO NEW FIRMS have been organized to buy and transmit 50,000 to 100,000 M.c.f. of natural gas daily from South Texas to the expanding West Coast main line of El Paso Natural Gas Co.

If the Federal Power Commission grants quick approval this spring, new lines can be built to handle 50,000 M.c.f. daily by November.

The new companies are Rio Gas Gathering Co., San Antonio, and Gulf Resources, Inc., New York.

Rio will buy gas from producers in several South Texas counties and build about 97 miles of 3 to 8-in. gathering lines to tie in with a 136-mile 20 and 14-in. transmission line to be built by Gulf Resources from southwestern Hidalgo County to Cotulla in LaSalle County.

El Paso plans to extend its mainline system eastward from Val Verde County to connect with the Gulf Resources line and thus add the new gas production to its system to the West Coast.

Railway Loses Rehearing Plea

LITIGATION involving former railroad land-grant properties in Colorado is headed for the U. S. Supreme Court.

This became apparent last week when the Colorado Supreme Court refused to reconsider an earlier decision. It had rejected claims by the Union Pacific Railroad to mineral rights on land it sold in the late 1800's to finance westward construction of the line.

The railroad claimed it retained rights to oil and other minerals underlying 160 acres of Logan County farmland in northeastern Colorado owned by Sara Mildred Radke and her brother, Edward F. Karr. The land is part of 16 million acres in Colorado, Wyoming, Nebraska, and Utah received by the railroad as grants from Congress in 1862-64. The suit arose after the owners leased the section to Platte Oil Co., Wichita, Kans.

December Imports Hit Peak for Year

• Crude excess of 126,300 bbl. daily to fan demand for mandatory controls. Voluntary program ends February 28.

DISREGARD for voluntary controls on crude-oil imports has risen sharply as importers awaited government action on a new control program.

Year-end totals released last week show that crude imports soared to 1,060,400 bbl. daily in December, when the present voluntary program had been scheduled to be replaced by stronger controls.

The December total was the highest since nation-wide allocations went into effect in January 1958. It jumped 126,300 bbl. per day above the recommended level of 934,100 bbl. daily.

Most of the excess over quota was in Districts 1-4, which includes practically all the nation east of the Rockies. Crude receipts in this area rose from 770,100 bbl. in November to 826,500 bbl. in December. They exceeded allocations by 57,100 bbl. daily in November and 113,500 bbl. in December.

In District 5, crude-oil imports averaged 233,900 bbl. a day in December. Allocations totaled 221,100 bbl. daily.

Crude Imports Topped Quotas in December

CRUDE OIL—DISTRICT 5

(Thousands of barrels daily)

	Allocation December 1958	Actual December 1958	Actual November 1958
Bankline	2.3	0	8.1
Caminol	2.8	2.8	2.8
Century	1.5	0	5.2
Douglas	4.4	6.8	3.3
Edgington	2.8	4.6	1.3
Envoy	1.2	0	0
Fletcher	5.2	5.2	5.2
Golden Eagle	2.3	2.9	0
General Petroleum	23.9	21.5	24.3
Hancock	4.0	0	0
Manespo	1.4	1.4	4.7
Macmillan	2.3	2.4	2.3
Mohawk	2.9	8.4	0
Palomar	0.5	1.0	0
Richfield	8.5	8.4	10.4
Rothschild	2.7	5.0	0
Shell	30.4	30.7	31.3
Socal Oil & Refining	1.0	3.5	0
Standard of Calif.	27.8	36.8	23.9
Sunland	2.3	0	7.0
Texaco	19.3	22.8	23.5
Tidewater	35.5	35.3	26.3
Union	11.6	8.6	10.9
U. S. Oil & Refining	7.5	0	0
Wilshire	17.0	25.8	15.3
Total	**221.1**	**233.9**	**205.8**

CRUDE OIL—DISTRICTS 1-4

(Thousands of barrels daily)

	Allocation December 1958	Actual December 1958	Actual November 1958
Atlantic	50.2	57.7	49.3
Aurora Gasoline	3.5	3.5	3.5
Bay Refining	2.7	5.5	4.0
Cities Service	27.8	30.5	28.8
Clark	2.0	0	0
Continental	5.0	2.0	5.0
Crown Central	4.3	4.3	4.3
Danaho	0.5	0.5	0.5
Delta	3.0	*9.0	*9.0
Dow Chemical	0.3	0	0
Eastern States	15.6	†53.1	†44.3
Gabriel	6.4	6.4	6.4
Great Northern	28.1	29.6	31.4
Gulf	95.1	96.7	96.9
Hess, Inc.	9.8	8.2	8.5
Ingram	3.5	3.8	7.9
International	10.5	12.5	17.3
Lakehead	0.3	0.3	0.2
Murphy Corp.	4.3	3.8	0.6
Northwestern	11.5	24.8	14.8
Ohio Oil	3.5	3.7	3.6
Phillips	10.2	10.3	9.9
Pure	5.0	6.1	3.9
Republic	4.0	5.0	0
Shell	6.4	12.0	1.6
Sinclair	53.0	53.0	53.7
Socony Mobil	57.2	55.1	63.4
Southwestern	2.5	12.0	11.5
Standard of Calif.	56.9	54.7	60.9
Standard of Indiana	25.4	25.2	29.1
Standard of N. J.	61.4	55.7	67.8
Standard of Ohio	7.0	11.6	9.0
Sun	43.0	50.5	53.6
Sunray Mid-Continent	5.0	3.6	5.7
Tennessee Gas	3.5	3.6	3.6
Texas Asphalt	2.0	2.0	2.0
Texas City Refining	4.0	3.3	4.1
Texaco	46.4	46.8	46.0
Tidewater	29.2	54.1	8.0
United	3.0	6.0	0
Total	**713.0**	**826.5**	**770.1**

*Estimated. †From Texas Railroad Commission.

UNFINISHED GASOLINE, OTHER UNFINISHED OILS

DISTRICTS 1-5

(Thousands of barrels daily)

	Average May-June 1958	Actual December 1958	Actual November 1958
Atlantic	5.7	3.5	8.3
Crown Central	5.6	15.9	3.0
Eastern States	12.3	†0	†0
Gulf	16.3	11.0	10.2
Hess, Inc.	25.3	25.9	43.5
Sinclair	7.3	6.1	7.4
Socony Mobil	19.7	21.9	21.2
Southwestern	4.1	4.0	4.5
Standard of Calif.	8.5	5.8	7.9
Standard of Indiana	24.8	17.6	32.2
Standard of Ohio	1.7	9.7	0
Texas City Refining	7.0	14.7	4.6
Texaco	13.8	14.6	14.4
Tidewater	20.0	23.4	28.7
Union	4.7	2.2	5.9
U. S. Oil & Refining	2.6	4.3	4.4
Total	**179.4**	**180.6**	**196.2**

†From Texas Railroad Commission.

The Interior Department tabulation shows that 22 of the 40 importing companies exceeded their quotas in Districts 1-4. On the West Coast, 12 of the 25 companies reported imports in excess of quota.

The volume of nonconforming crude coming into this country was the greatest since the early days of the voluntary program in mid-1957. At that time, the program covered only Districts 1-4.

Despite the sudden jump in imports late in the year, Interior noted that for the 12 months ending December 21 crude receipts were 9,600 bbl. below the average allocation. Nationwide crude imports for the period averaged 941,700 bbl. daily.

Unfinished products, which were brought under the program July 1, averaged 170,000 bbl. daily for the last half of the year. This average was slightly below the allocation of 179,400 bbl. a day.

In December, imports of unfinished products covered by voluntary restrictions averaged 180,600 bbl. a day. This compares with imports of 196,200 bbl. per day in November and an allocation of 179,400 bbl. per day.

Trend continues . . . Later figures compiled by the Bureau of Mines and industry associations indicate the sharp climb in imports has continued into the new year.

The recent trend is expected to bring a new round of demands for mandatory controls. Many critics of the voluntary program, both in the industry and in Congress, have charged the present program had failed.

Just last week the cabinet fuels committee announced it will make a new study of imports with hopes of hammering out a new control plan (see p. 55).

February Allowables Steady

THREE STATES have set the February crude production allowable at the same level as January.

Louisiana's new allowable is 863,500 bbl. daily This is about the same as last month, except for an increase of nearly 7,500 bbl. daily for new wells.

The Oklahoma Corporation Commission set the February allowable at 560,000 bbl. daily, the same as the December and January figures. Kansas is holding the allowable steady for the fourth consecutive month at 327,000 bbl. daily.

Earlier, the Texas Railroad Commission set an 11-day producing schedule, with an initial allowable of 3,194,826 bbl. daily. This is an increase of 66,460 bbl. over January's initial allowable (OGJ, Jan. 19, p. 69).

watching WASHINGTON

Joe Reilly

• Congress may act on imports controls

THE OIL INVESTIGATION BY SEN. JOSEPH C. O'MAHONEY threatens another delay in development of new imports controls.

The cabinet fuels committee now has an easy out if it wants to toss the whole problem back in the lap of Congress. Present voluntary controls are scheduled to expire February 28. Any new program that might be worked out before then can expect a cool reception from the O'Mahoney subcommittee.

Because of the futility of its task, the cabinet committee may decide O'Mahoney is right when he says it is "a legislative problem, not an executive problem."

Whether or not a new program is proposed before the February 28 deadline, Congress will have a chance to write its own controls. Congress had a similar opportunity last year, but it chose to leave the solution to President Eisenhower.

As chairman of the public-lands subcommittee, O'Mahoney is preparing to delve immediately into the mysterious workings of the oil industry. So far, he has revealed plans to look into two specific problems —naval petroleum reserves and oil imports. Before he is through, many other problems may attract his attention.

The Wyoming Democrat already has worked out a plan to take care of the oil reserves. He is sponsoring a bill to turn them over to the Interior Department for leasing to private industry.

As far as oil imports are concerned, O'Mahoney thinks they have been detrimental to the domestic industry. That's what the administration decided a long time ago. To date, the administration has failed to come up with an equitable solution. Will Congress come any closer to the answer than it did last year? If not, charges of "failure" on the part of the administration will sound pretty hollow coming from congressmen.

• What to expect from depletion foes

THE FUROR OVER IMPORTS IS A PRELUDE to the battle over depletion which congressional leaders expect later in the session.

The House ways and means committee has two bills seeking to cut the rate for oil and gas to 15%.

In introducing one of the bills, Rep. H. R. Gross (R-Iowa) gave a sample of the wide range of anti-depletion arguments that can be expected before the session ends.

"Let me make it clear at the outset that I am not opposed to a reasonable depletion allowance," he said, "but I am convinced that an allowance of 27½% is entirely too high."

Gross suggested a depletion cut as one means "to attain the goal of a balanced budget." He also sees it as a possible alternative to an increase in postal rates.

The Iowa congressman claimed the depletion allowance as originally enacted was to apply only until the capital invested in exploration was recovered.

As far as Gross is concerned, there is "nothing sacred" about the present rate. Because of it, the oil and gas industry "is the most highly subsidized segment of American industry."

Even if the 27½% rate is needed as an incentive for exploration in the United States, "why is the same percentage permitted in connection with the overseas operations of great oil combines?" he demanded. He said some of these "combines" pay little or no taxes to the U. S. treasury.

His bill, Gross believes, would at least partially close a "glaring loophole" in our tax laws. What's more, it would increase revenue an estimated $300 million or more.

That's about all that will be said against depletion this year. But it will be said over and over.

IPAA Sets Lofty Goal

. . . in campaign for U. S. energy supremacy. One object: cooperation of all energy industries in solving problems.

A PROGRAM to interest all energy industries in their common problems was launched by the Independent Petroleum Association at a press conference in New York last Wednesday.

The action is the outcome of criticism leveled at the oil industry for keeping to itself and not cooperating with others in solving common problems.

The program is hinged on 1959 as the "Energy Supremacy" year. Representative Overton Brooks of Louisiana, chairman of the House committee on science and astronautics, has introduced HR 140 calling for the director of the National Science Foundation to issue a proclamation to that effect.

Judge Gordon Simpson, IPAA president, initiated the program by sending letters to 216 leaders in other energy industries urging their use of the "Energy Supremacy" theme in the interpretation of their industry problems.

In launching the program, the group outlined problems facing all "mineral fuel and power resource industries" in meeting growing energy demands.

The IPAA cited the need of an adequate energy supply, not only as a guarantee of high living standards, but as a weapon of peace—"the controlling tool of survival in the Free World" threatened by communism.

In pointing out that oil and natural gas supply about 70% of the nation's energy requirements — with demand predicted to reach 20 million barrels daily in 10 years—the IPAA said the U. S. has no other choice than to find, develop, and maintain sufficient petroleum supplies.

The manifesto declared government policies "can be directed, overall, to either encourage or discourage resource development and energy availability for the future."

It urged cooperation from other industries to block any disruptive influences, such as adverse government policies or laws which would cut down on development of energy resources.

Campaign plan . . . To guard against threats to the nation's position of energy supremacy, the IPAA pledged itself to a 10-point program.

In its declaration of policy, the IPAA said it will:

. . . **Support scientific** studies of the nation's oil and natural-gas reserves to assure future demand can be met.

. . . **Promote better** understanding between the various segments of the oil industry.

. . . **Find ways** to increase efficiency and cut costs for the benefit of the industry and the consumer. A special committee has been set up for this purpose.

. . . **Expand efforts** to show an adequate price for products is essential to encourage exploration and development of additional supply.

. . . **Promote wider** understanding of the necessity of differential tax treatment. The IPAA organized a special depletion study committee, is encouraging academic studies of the depletion provisions, and is expanding its activities to make factual information on tax provisions available.

. . . **Push for a policy** to put more teeth in present oil-import restrictions.

. . . **Seek repeal** of "present burdensome and impractical federal utility-type controls" on independent natural-gas producers.

. . . **Encourage research** and industry-wide studies aimed at solving common problems.

. . . **Continue support** of legislative and administrative policies encouraging multiple use of public lands for mineral and petroleum development.

. . . **Work and cooperate** with all energy-producing industries in interpreting to the American people the threats to the nation's energy development.

Big Unit Approved

in Oklahoma. Huge recovery expected at Velma project.

OKLAHOMA'S largest gas-repressuring program, which is expected to increase recovery by 242,000,000 bbl. of oil, will get under way in Velma field, Stephens County, this spring.

Skelly Oil Co., unit operator, expects to start injecting gas in the sharply dipping Sims sand about April 1. This was announced after the Oklahoma Corporation Commission approved the 3,694-acre unit last week.

Skelly, which owns about 60% of the field, and other operators have been working on the unit for about 3 years. Hearings had been going on since last summer, with some opposition coming from operators on the east downdip side of the structure (OGJ, Nov. 24, 1958, p. 52).

Gas injection is expected to boost ultimate recovery from 18 to 49% of original oil in place. At time of discovery about 14 years ago, oil in place was estimated at 776,000,000 bbl.

The plans . . . The structure dips drastically from 2,400 ft. on the west side to 7,500 ft. on the east side. Initial

PIPELINE BRIEFS . . .

Talk of a crude pipeline from North Dakota to the St. Paul-Minneapolis area has been revived by Great Northern Railway and Amerada Petroleum Corp. Great Northern made a feasibility study 2 years ago but shelved the project pending strengthening of the crude market (OGJ, May 27, 1957, p. 97).

Amerada last week confirmed it has been talking with Great Northern about a line which would open increased markets for Williston basin crude outside North Dakota. It's too early to determine the outcome of the talks, Amerada said.

A $30,000 damage suit has been filed by Houston Contracting Co. against the International Union of Operating Engineers in federal district court in Houston. The company charges the union placed picket lines at warehouses in Harvey and Lafitte, La., and that union employes of Houston Contracting stayed off their jobs. The picket lines were set up because a subcontractor's workers did not belong to the union, the petition said.

A pipeline to transport sour crude from Weyburn field to the Regina and Mose Jaw, Sask., refinery centers is being considered by Trans-Prairie Pipelines, Ltd. A feasibility study has been made based on sales of 12,000 bbl. to refineries of Imperial, Consumers' Co-op, British American, Husky, and Petroleum Fuels.

Increased delivery to gas-short communities in Michigan, Indiana, and Ohio is sought by Panhandle Eastern in an application filed with FPC. Gas intended for the new markets will be available March 15 when the company stops deliveries to Michigan Consolidated. Last month the FPC

injection through about five wells will be on the updip side.

Most of the final plans have yet to be worked out by the operators committee, which is scheduled to meet this month. Gas for the program will come from Skelly's natural-gasoline plant at the town of Velma.

The field has 275 wells producing about 6,200 bbl. of 29°-gravity oil daily. Since discovery, reservoir pressure has dropped from 1,735 psi. to the current 500 psi. Skelly plans to maintain the pressure at that level.

Premium Takes Big Jump

AVERAGE QUALITY of premium gasoline took its biggest jump in more than a year last month when it went up 0.2 of an octane to a nationwide average of 99 research octane.

The January increase was the first of this size since November 1957, when the average went up 0.3 of an octane. There were only four increases in the national average in 1958, in February, September, October, and November. Each was 0.1 of an octane.

Of the 57 cities covered in Ethyl Corp.'s monthly survey, 31 averaged 99 octane or more. Six of the cities showed premium of 99.5 or more. San Francisco and Seattle were tops with 99.7 averages.

The January increase puts the premium average 0.6 higher than a year earlier. Regular, unchanged from December's average of 91.5, was 0.5 higher than a year ago.

Leasing Crackdown Begins

. . . as Interior seeks to cancel 86 Wyoming leases. More complaints scheduled in another state in about 2 weeks.

THE INTERIOR Department has moved to cancel 86 oil and gas leases covering more than 63,000 acres in Wyoming, which allegedly were obtained by fraudulent means.

A complaint filed in Cheyenne last week was the first step in the department's recently announced campaign against leaseholders accused of violating the legal acreage limitations.

Walter G. Davis, Casper, Wyo., and 85 other parties were named in the complaint filed by Ed Pierson, state supervisor for the Bureau of Land Management.

The complaint is the first of several which the bureau plans to file under the crackdown announced early in January by Interior Sec. Fred A. Seaton. Next action, due in about 2 weeks, is expected to be aimed at leaseholders in another state.

Seaton's drive is directed chiefly at companies or individuals whose federal lease holdings exceed the limits established by the Mineral Leasing Act of 1920. Under that law, no company or individual may hold more than 100,000 acres of federal oil and gas leases in Alaska or more than 46,080 acres in any other state.

Until 1954 the limit was 15,360 acres in any one state. The first complaint charges violation of the lower limit, in lease acquisitions dating back to 1951.

Some of the leases involved are productive, but the volume of production was not disclosed.

What's involved . . . Davis is accused of trying to avoid the acreage restriction by having other persons obtain leases in their names while leaving him with controlling interest.

Named with Davis are firms and individuals accused of assisting or conspiring with Davis in obtaining the leases, as well as other parties who later acquired interests in the challenged leases.

Interior is seeking to cancel the leases on grounds that they were "falsely and fraudulently" obtained.

The complaint maps the procedure under which the department intends to nullify the leases. Contestees will have 30 days in which to file an answer to the charges. After that, they will be entitled to a hearing before a BLM examiner.

If the examiner directs that any of the leases be canceled, contesting parties can appeal to the director of the Bureau of Land Management, then to the Secretary of the Interior. Final jurisdiction would rest with the federal courts.

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authorized Panhandle Eastern to end service to Michigan Consolidated (OGJ, Dec. 29, p. 76). The order involves 127,000 M.c.f. daily.

Canadian oil-pipeline deliveries decreased 12% in November over the same month a year ago in spite of a 34.6% drop in exports. November deliveries were 23,414,831 bbl., which was 2.3% above October. For the first 11 months of 1958 deliveries were 248,832,686 bbl., or 6.8% below the 1957 period.

Regulation of Colorado Interstate Gas Co.'s direct sales of natural gas has been assumed by the Colorado Public Utilities Commission. The commission said 25 to 35% of CIG's business in the state is direct sales to industries, utilities, and municipalities which "are subject to the arbitrary control" of CIG both as to price and service. The commission said CIG has not been unreasonable in setting rates but that "such power must be subject to reasonable and constitutional processes and the police power of the people of Colorado." The pipeline may appeal in the courts.

A permanent certificate for construction and operation of new pipeline facilities costing an estimated $169,329,000 last week was granted by the FPC to Tennessee Gas Transmission. The company had already spent about $127,000,000 on the project under temporary FPC authorization. When completed, the project will increase average delivery capacity of the TGT system by 405,599,000 cu. ft. daily.

Pacific Gas & Electric plans to build 307 miles of gas line in California during 1959. This program is exclusive of the Alberta & Southern project from Alberta to San Francisco which is scheduled for 1960. PG&E is expanding capacity the first half of this year by installing compressors at four locations.

Also for Pipeliners . . .

IN THE NEWS: Gas utilities may turn to liquefaction plants as means of meeting winter peak-demand periods (p. 51) . . . Little Inch tariffs will be reduced starting in March (p. 71).

A complete list of pipeline projects is carried in the last issue of each month. Current projects are reported in Pipeline Briefs.

PLUS THESE TECHNICAL REPORTS: Sohio cathodically protects bare pipe economically (p. 80) . . . Pipe failures: Causes, effects, and prevention (p. 116).

Oil Feels Tax Bite From Legislatures

. . . in Texas and California. Lawmakers and governors in both states make industry target for new revenue bills.

THE OIL industry in Texas and California is finding itself in the uncomfortable but familiar role of favorite tax target for state legislators and governors.

Both states are faced with the need of substantial increases in state revenue to meet greater budgets.

Lawmakers in both are considering imposing new or increased severance taxes on oil and gas to bring in the funds.

In Texas

Legislators at Austin have introduced two tax bills which would hit the industry hard.

Their aim is to help raise part of $220 million needed over the next 2½ years to wipe out state deficits and meet estimated spending needs.

One would levy a 3% "severance beneficiary" tax on gas reserves dedicated under long-term contracts. This tax, endorsed by Gov. Price Daniel, would take in an estimated $41 million over the next 2 fiscal years—$19.7 million the first year, $21.3 million the second.

The second bill would amend the present 4.6% severance tax on oil production. It calls for graduating the levy from 4.6% to a top of 7% on production in the state of more than 5,000,000 bbl. a month. This one, introduced in the house by Rep. Robert C. Eckhardt, Houston, would yield an estimated $13 million annually.

The gas tax . . . The proposed gas levy would fall on what the bill defines as the "severance beneficiary."

This, the author says, is the person or corporation from whom gas is produced and to whom it is first sold by the producer. The transfer can come under a dedication contract or any other agreement of sale made prior to production whereby exclusive rights to the gas are acquired.

In most cases, this would be the pipeline. But in some, the producer would pay. The bill is the latest of a string of attempts by the Texas legislature to tax gas taken out of the state.

The only one previously passed was slapped down by the U. S. Supreme Court in 1954 as an unconstitutional burden on interstate commerce. This was the famed "gas gathering tax" passed by the legislature in 1951 and fought through the courts for 3 years.

The current bill, its sponsors say, will not be unconstitutional. The tax would not be on interstate commerce or the taking of gas in interstate commerce. Incidence would be on production of gas which, sponsors say, was specifically approved by the Supreme Court.

The tax would apply equally to gas in intrastate and interstate commerce. It would be a "broad-based tax" which the legislature presumes would be passed on eventually to the gas consumer wherever located.

Sponsors claim this is the beauty of it since roughly 46% of Texas-marketed gas production is consumed outside the state. The share of the tax which would fall back on the Texas producer, they say, could not possibly amount to more than 18% of the total collected. The sponsors don't estimate how much of the total intrastate pipelines would have to pay.

The oil tax . . . The graduated oil tax would be applied to all production by a single operator totaling more than 700,000 bbl. a month.

All producers would pay at least 4.6% of value (the present tax). How much more would depend on volume of production.

Sponsor Eckhardt contends that it would raise the taxes on only 17 oil companies and that these 17 firms would pay roughly $13,200,000 more in taxes.

Eckhardt argues the tax "is by no means excessive" and is based "on ability to pay in the oil industry." Actually, he says, the bill would increase the severance tax bill of the majors slightly under 1%.

Opposition growing . . . New taxes on oil and gas will not be levied without strong opposition from the Texas industry.

Charles W. Alcorn, president of the Texas Mid-Continent Oil and Gas Association, quickly opposed the gas tax or any other levies which would hike the industry's heavy tax burden in Texas.

"We are disappointed," he said, "that the governor has chosen to make the oil and gas producers of Texas the scapegoat again in another piecemeal approach to our state's fiscal problems.

Daniel struck back last week, saying he was ready to fight for the new gas tax. He declared the plan "is not a tax on the producer but on companies which have a major portion of the gas reserves of the state tied up under contract."

In California

Oil and gas producers in the Golden State learned only last week they figure heavily in newly elected Gov. Edmund (Pat) Brown's plan for financing a record $2-billion budget.

Gov. Brown asked for a 2% severance tax on oil and gas production in his budget message to the legislature. He said he hoped to raise $23 million per year with the tax.

Based on past experience, odds favor passage of the tax.

The Western Oil and Gas Association, however, quickly pointed out that the California industry already pays taxes equal to or higher than those paid in other states even without the severance tax. On an average, property taxes cost California producers around 20 cents per barrel now.

"Thus, if a severance tax is added to the taxes already levied on oil production in California, the total tax on California oil will be completely out of line with the tax in other states," Felix Chappellet, general manager of WOGA said.

"Advocates of a severance tax have made much of the existence of such taxes in Texas, Louisiana, and Oklahoma," Chappellet said. "However, in these other states, either property taxes are much lower or nonexistent."

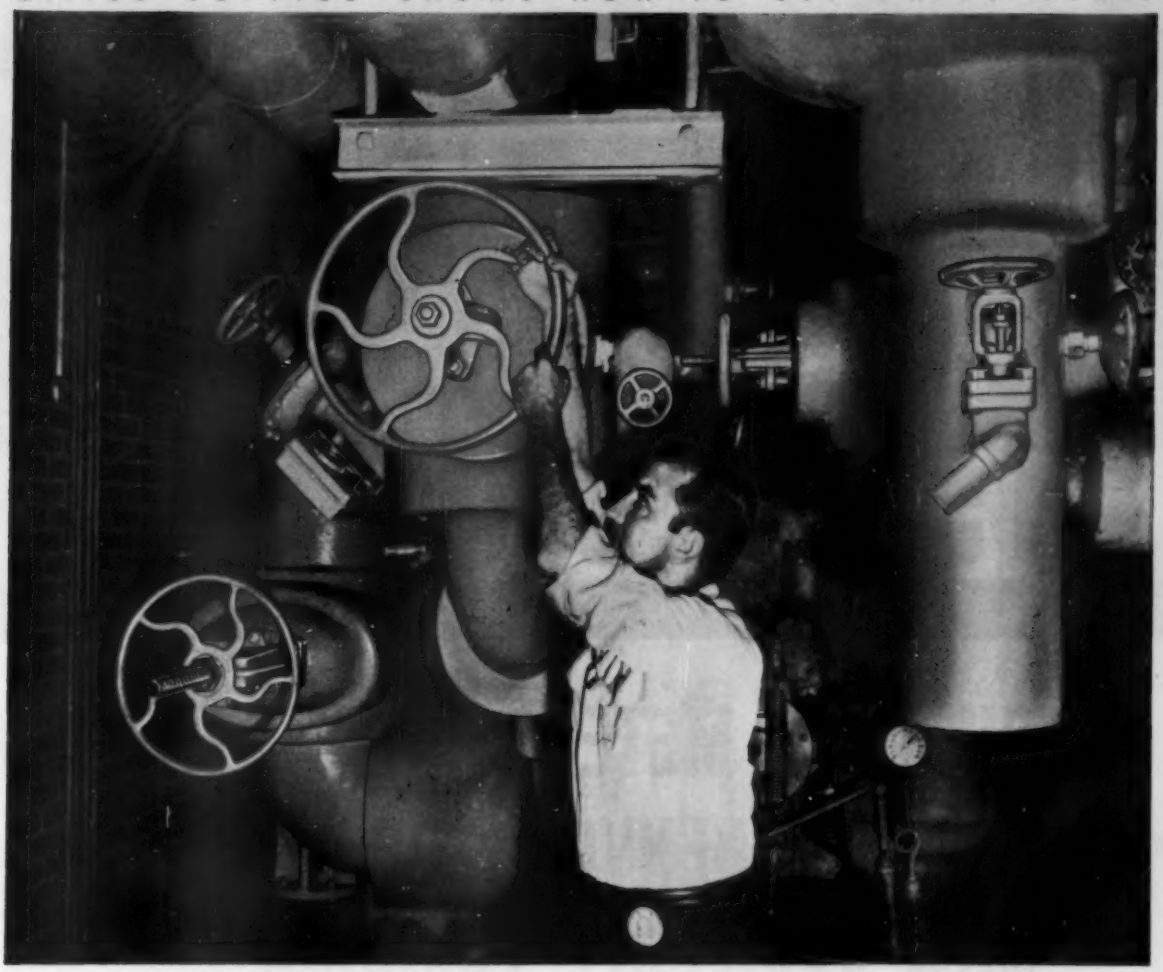
Actually, the governor's recommended rate wasn't as high as one proposed by a Princeton economics professor hired by the California Teachers Association. Paul J. Strayer, making a study of potential sources of new revenue told the teachers group the Texas formula of 4.6% on oil and 7% on gas would raise $60 million for the state.

Gasoline levy . . . Products also are coming in for their share of scrutiny by the legislators.

A bill was introduced during an early session which would make permanent the state's 6-cent gasoline tax. As it now stands, the rate will revert to 5½ cents July 1.

Gov. Brown has given assurance he will lay off gasoline taxes. But it is rumored that a powerful group of city and county organizations in the state probably will ask for a 1-cent gasoline tax increase shortly.

Cities Service shows how to cut valve costs



Crane globe valve in 14th year on steam turbine line

Cities Service Refining Corp. uses hundreds of valves at its Lake Charles, La., plant. Maintenance and replacement costs could be staggering, but for careful control of valve selection.

For example, the Crane 6-inch, 300-pound steel globe valve shown above was installed at the Lake Charles plant 14 years ago. Working at 250 psi., 600 deg. F., the valve is used in the steam line to a turbine-driven feed-water pump.

In spite of its operation 3 or 4 times a week, this sturdy Crane valve has continued tight in service and has required no repairs in 14 years!

Thrifty buyers want no better reward than the kind of cost-cutting, dependable service they get when Crane valves are installed.

That's why in the petroleum industry, as in all industries, you'll find more Crane valves used than any other make.

This is the valve used on installation above. CRANE 151XR, 300-pound cast steel globe valve for 850° F. maximum temp. Sizes: 2 in. to 8 in. For full details, see your Crane Representative, or write to address below.

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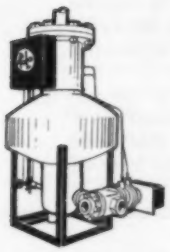
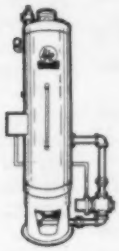
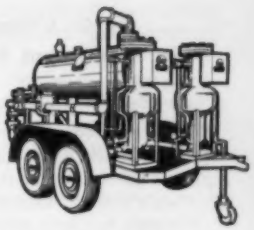


OIL AND WATER METERS



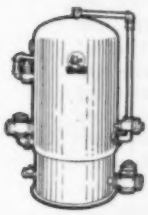
METERING SEPARATORS

METERING HEATER-TREATERS

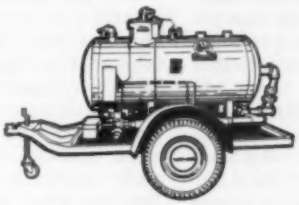


WELLCHECKERS

Used by every major oil company and numerous independents in the United States and 23 foreign countries.



AUTOMATIC CUSTODY TRANSFER METERS



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MOVING SLOWLY through soggy muskeg is track unit used by Shell.

Muskeg Barrier Dented

. . . by oil's mechanized attack on Alberta front. Shell's rig move fans hope of ultimate victory in perennial war.

AFTER a successful skirmish—which followed numerous defeats—the oil industry is waiting for the spring thaw to resume its battle against Canada's mucky, treacherous muskeg.

Progress has been made, but further field tests are needed to determine how far the industry has advanced in the war to conquer the black, smelly barrier to year-round exploration of northern Canada.

Oil men, whose operations in the muskeg areas have been limited to the winter freeze-ups, are confident of eventual victory. But progress has been slow.

A promising advancement was chalked up last summer by Shell Oil Co. of Canada, Ltd. Shell successfully moved a rig by overland transport through muskeg country in northern Alberta for the first time.

The rig was transported from Steen to Shell's Steen River well site—12 miles through muskeg—and then back out again.

Although considered a minor victory, Shell officials point out the move "was just one experiment in a particular situation . . ." They add that considerably more testing will have to be carried out and some modifications are required.

Equipment used . . . The move was accomplished by three Nodwell Transporters, giant track units built by the Nodwell division of Robin Equipment Manufacturing, Ltd., in Calgary.

The transporters are 39 ft. long, 10 ft. wide, with nylon-cotton track belts 47 in. wide. The track units, which cover a 28,000-sq.-in. area, exert a ground-bearing pressure of 2 psi.—less than that of a man standing on both feet.

The machines, which weigh more than 35,000 lb., are equipped with hydraulic ram steering, an 18,000-lb. winch, and a large, flat-bed trailer mounted behind the cab. They are powered by two 105-hp. engines, one powering the front tracks and the other the rear tracks. They have a top speed of 12 m.p.h., can execute a 50° turn in 20 seconds, and have a load capacity of 20,000 lb.

John Stuart, Shell area automotive superintendent, says the machines worked well during the moves and that modifications required are considered minor.

How it was done . . . The difficult task of clearing a trail through the muskeg preceded moving the rig.

The trail was cleared by two wide-pad TD-14 International Crawler tractors and the Cuthbertson Water Buffalo, which has also been undergoing a series of tests.

The transporters then hauled the equipment and rig components—broken down in 6-ton loads—making a speed of about 6 m.p.h. A total of 284 tons of equipment was moved to the location during the 17-day operation. The move-out of 178 tons of equipment was completed in 10 days.

The same rig later was moved to a second drilling location by the transporters before the machines were returned to Calgary for further testing and modification.

Other fronts . . . Also making progress in the industry war against the soggy muskeg is Imperial Oil, Ltd.

Predicting ultimate success is Alex Hemstock of Calgary, Imperial Oil research engineer and a veteran of muskeg transport problems.

"Ten to 15 years from now, we'll be running over that muskeg in machines as a matter of course," he says.

With James Thomson, a vehicle specialist, and others, Hemstock has worked with a half-dozen vehicles designed to beat the muskeg barrier to potentially rich oil and gas areas. Their latest is the Musk Ox, which weighs about 25 tons and is capable of carrying 20 tons. It has tracks 52 in. wide, which also exert a pressure of 2 psi.

The vehicles developed so far are stepping stones to the ultimate goal: A vehicle which can carry loads over any kind of muskeg at any time of the year.

PROCESSING

Two new synthetic rubbers will be produced at a plant to be built by Firestone Tire & Rubber Co. at Orange, Tex. The new products are Diene, a butadiene-based material which is a partial replacement for natural rubber, and Coral, an isoprene-based material which is the man-made equivalent to natural rubber. The new plant will have annual capacity of 30,000 tons of either product. Firestone will be able to switch from production of one to the other, as demand requires.

A high-density polyethylene plant, built by Dow Chemical of Canada at Sarnia, Ont., will begin operation this month. First shipment of product is expected in March.

A fourth-quarter profit — the first in the company's 3-year history—was reported by Commonwealth Oil Refining Co. at Ponce, Puerto Rico. Stockholders were told the company,

Role of Engineer Changing

. . . under impact of growing use of digital computers. The future emphasis will be on engineering creative talent.

PETROLEUM ENGINEERS and scientists face much greater demands on their talent in future years than ever before.

Paul W. Stade, senior reservoir engineer for Atlantic Refining Co., predicts that growing use of digital computers will be responsible for this new strain on engineer talent.

Computers, he advises petroleum-engineering students at the University of Texas, will take over more and more of the routine, time-consuming tasks. They will free the engineer for more creative work.

The time between creation and application will be shortened. And the engineer thus will be forced to create at a greater rate, Stade says.

Growth amazing . . . The role played by the computer today is phenomenal, Stade stresses, when you consider that the first of the modern-day electronic computers began operating just 12 years ago in 1947.

A semi-automatic computing system was available on a commercial basis in 1949. But the first truly automatic system for commercial use did not appear until 1951. Today, there are an estimated 2,000 computers in use, another 2,000 on order. By 1965, more than 10,000 computers will be operating.

Twenty different firms now manufacture various kinds of computers, and there are about 35 different models of various sizes and costs available.

Despite the rapid growth in use, however, engineers (and businessmen) have only begun to develop a mass understanding of what they can do and how they can be used, Stade reports.

Effects on engineering . . . Stade lists six ways that computers will affect the engineer's work in the future. The engineer, he says, will have to:

. . . Gain understanding of what computers can do and how to use them.

. . . Develop methods more complete and more scientific to use computers for solving his problems. This will require precise planning and considerable imagination.

. . . Spend more time developing new concepts and approaches to his problems and the computer programs for applying them. New programing techniques will enable him to use the computer on a much wider range of problems.

. . . Know more about the place of his work in the over-all picture of the business of which he's a part. His work and that of others will be better integrated in many areas.

The computer will provide him with:

. . . Better answers quicker—answers that can be applied fast to day-to-day operations.

. . . Usable basic data in greatly increased amounts. He will spend less time handling or comparing these data and more time in deciding its significance and how to analyze it with the computer.

Du Pont Tests New Additive

STATIC ELECTRICITY hazards may be curbed by a new nonmetal additive.

Du Pont says its new SCA-100 compound, currently under development, may prove useful in both refinery stocks and finished products where there is a hazard of explosion or fire induced by static discharge.

The additive is a mixture of complex organic compounds containing nitrogen. It increases the electrical conductivity of fuels, such as gasolines, kerosine, distillates, diesel fuels, plant feed stocks, and naphthas, and is most effective in fuels which develop either positive or negative electrical charges.

BRIEFS . . .

which is in the midst of an improvement program, grossed $60,986,000 during 1958 and had a net loss of $2,673,000. However, an upward trend was indicated by the brighter final-quarter picture, which showed gross revenue totaled $15,986,000 with a net profit of $161,000.

Major construction will start early this month on Shell's gas-processing and cycling plant in Louisiana's Weeks Island field. Contractor is Farnsworth & Chambers, Inc. The plant, about 20 miles south of New Iberia, will have a capacity of 120,000,000 cu. ft. of gas daily. After recovering all liquids, Shell plans to reinject 70,000,000 cu. ft. and sell the rest of the gas. Two injection wells and three more producing wells will be drilled on the north flank of the structure.

Western Natural Gas Co., Houston, has purchased McBride Oil & Gas Corp.'s refinery near Brownsville, Tex., and plans to rebuild it. The plant will produce asphalt, kerosine, and diesel fuel and will have initial capacity of 3,500 bbl. daily. This can be increased to 5,000 bbl. Western Natural will build three small natural-gasoline plants in Texas to furnish part of the stream for the refinery. The plants will be in San Salvador field, Hidalgo County; Nursery field, Victoria County; and St. Charles field, Aransas County. Western Natural is affiliated with El Paso Natural Gas Co.

Cities Service is probing the cause of an explosion that killed the operator of the coking unit at the company's 33,500-bbl. Ponca City, Okla., refinery. The explosion was in the unit's fractionating tower, and the fire was put out within a half hour. No estimate of damage has been given. The damaged unit was shut down, but other operations were not affected.

A 7,000-bbl. delayed coker will be built at Suntide Refining Co.'s 65,000-bbl. Corpus Christi, Tex., plant. The $3-million unit will be built by the newly formed Coastal Products Co., jointly owned by Suntide and Sunray Mid-Continent, and will be operated by Suntide. Construction will start about April 1, with completion scheduled by the end of the year. Charge stock will come from the Suntide refinery and other Gulf Coast plants. Coke will be sold to an outside firm for production of graphite electrodes. All other products will be used by Suntide.

Also for Refiners . . .

IN THE NEWS: Liquefaction plants may find big use in U. S. as standby facilities for meeting winter peak-demand periods for natural gas (p. 51) . . . What does unionized labor want from oil management? (p. 53) . . . Cabinet committee to make new imports study to determine control plan (p. 55).

PLUS THESE TECHNICAL REPORTS: Cat reforming with RD-150 catalysts (p. 88) . . . Engineering flowsheets in plant design (p. 92).

Portable X-ray unit used by CB&I to inspect welded seams on field erected work.

Two 31-foot diameter Hortonspheres® designed for 250 lbs. per square inch pressure, store propane at Company's Torrance, California refinery.

Multiple point potentiometer is used to electronically record the temperatures on various points of the structure during stress relieving.

Hard Working HORTONSPHERES® stress relieved and X-rayed in the field

To meet a specific set of customer requirements, these high pressure, 2,778-barrel capacity Hortonspheres were fabricated at CB&I's Salt Lake City plant and then stress relieved and X-ray inspected *after* they were erected for General Petroleum Corporation's refinery.

Field X-ray and stress relieving facilities are typical of the many highly specialized metallurgical techniques and equipment which CB&I has pioneered and put to work on structures that *work* rather than merely *serve.*

Such facilities point up the many "extras" you get when you specify CB&I . . . the engineering service and attention to metallurgical details that mean a *lot* in today's complex refining operations.

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Welded steel structures **serve better and last longer with CB&I coordinated services.**

Repair Work Starts

on platform that sank in 35 ft. of water off Louisiana.

DIVERS sought last week to repair the hull of a hard-luck mobile drilling platform that sank in the rough waters of the Gulf of Mexico before it could be refloated from a 30° list.

Trans-Gulf Offshore Drilling Co., owner of the platform, said it may be weeks before the platform can be made watertight and the water pumped or forced out.

Bad weather has plagued the salvage operations off Louisiana from the start and was responsible for the second accident to the platform.

The platform first listed on January 10 while the 25-man crew was lowering it in preparation for moving (OGJ, Jan. 19, p. 62). On January 21, heavy seas snapped the platform's 12 legs and caused it to settle to the ocean floor in 35 ft. of water (OGJ, Jan. 26, p. 113).

A Trans-Gulf spokesman said an independent surveyor's report shows that a failure of the soil foundation caused the original listing. Extent of damage to the hull, which sits upright, has not been determined.

When divers complete the repairs, salvage crews will attempt to pump out the water. If this fails, air will be used to force out the water.

J. Ray McDermott & Co., Inc., is doing the salvage work for Trans-Gulf. Reading & Bates Offshore Drilling Co. was operating the platform at the time of the accident.

Reading & Bates was drilling a development well for Gulf Oil Corp. in Block 21, south of Timbalier area and Leesville, just prior to the accident.

Trans-Gulf said it is fully covered by insurance on the value of the platform.

Little Inch Cuts Tariff

TARIFFS for shipping products over the Little Big Inch pipeline will be reduced effective March 1.

Millard K. Neptune, senior vice president of Texas Eastern Transmission Corp., said new rates from Beaumont to Chicago on the 20-in. line will be 40 cents per barrel on gasolines and 44 cents on distillates. This compares with the 48-cent tariff now in effect for both products.

Comparable reductions will be made for other destinations on the line, which originates in the Houston area and ends at Lebanon, Ohio. Neptune said lower tariffs would make the use of the war-built line, converted from natural gas last year, economically feasible for more shippers.

Among the reasons cited for the reduction were elimination of the 4½% transportation tax on pipeline shipments and lower capital investment and operating costs than were expected. The new rates apply on all shipments which move only over the Little Big Inch. Joint tariffs with other pipelines are not affected. Propane shipments are covered by separate tariffs, which will be revised soon.

Merger Is Off

between Texas Pacific and Sinclair. State steps in.

SINCLAIR Oil Corp. has dropped its offer to purchase assets of Texas Pacific Coal & Oil Co., following intervention of the merger by the State of Texas.

The state's attorney general last week obtained a temporary restraining order, preventing Texas Pacific directors from voting on a Sinclair merger proposal.

The state charged violation of Texas antitrust and monopoly laws by Sinclair and Lehman Brothers, New York investment bankers. Also sought is a permanent injection against the merger and a decree requiring Sinclair to get rid of its Texas Pacific stock.

P. C. Spencer, Sinclair board chairman, denied vigorously that his company had violated any law in acquiring its Texas Pacific stock or that it has attempted to dominate the Texas Pacific management. Sinclair owns 29% of Texas Pacific stock. The merger was proposed late last year (OGJ, Dec. 1, 1958, p. 91) at which time Sinclair offered to acquire the rest of the stock, valued at around $110,000,000.

The purchase would have given Sinclair a much-needed boost in crude reserves. Texas Pacific's net crude production is about 21,500 bbl. daily.

Following the Texas Pacific board meeting last week, H. B. Fuqua, president, said the board voted to conform with the court order.

the JOURNAL *said . . . . . .*

50 years ago

February 6, 1909

A cargo of 8,100 tons of benzine arrives in San Francisco from Japan, via Singapore. The captain and 53 Chinese crew members were not allowed to smoke, for fear of explosions.

James Scott Glenn dies. His fabulous career was highlighted by leasing 1,500,000 acres in the Osage nation, Indian Territory, in 1896 from the U. S. Indian Territory Illuminating Oil Co. was formed and in 10 years drilled 700 wells.

In 8 years since Spindletop, U. S. oil production has trebled. It reached an estimated 200 million barrels in 1908.

British torpedo-boat destroyer Tartar breaks all speed records, assisted by the tide, by making 40.3 knots, or almost 46 miles an hour over the Barrow deep in the North Sea. It burns Texas fuel oil.

25 years ago

February 1, 1934

Compulsory blending of 10% by volume of domestic agricultural alcohol with U. S. motor fuel is asked in congressional bill. Similar plan angered French motorists.

About 35,000 bbl. of "hot oil" is run daily in East Texas field. Administrator Harold L. Ickes and federal aides report 1,996 violations in 1933 and 529 injunctions granted. Detailing ingenuity of violators, report says one "hot oil" by-pass was found in the bathroom of a small home. When officers searched, the lady tenant locked the bath door, defied entrance.

Only four instances of shell failure were found among thousands of tanks used in California oil operations and most tank construction is earthquake resistant, an API committee reports after study of a 1933 tremor.

10 years ago

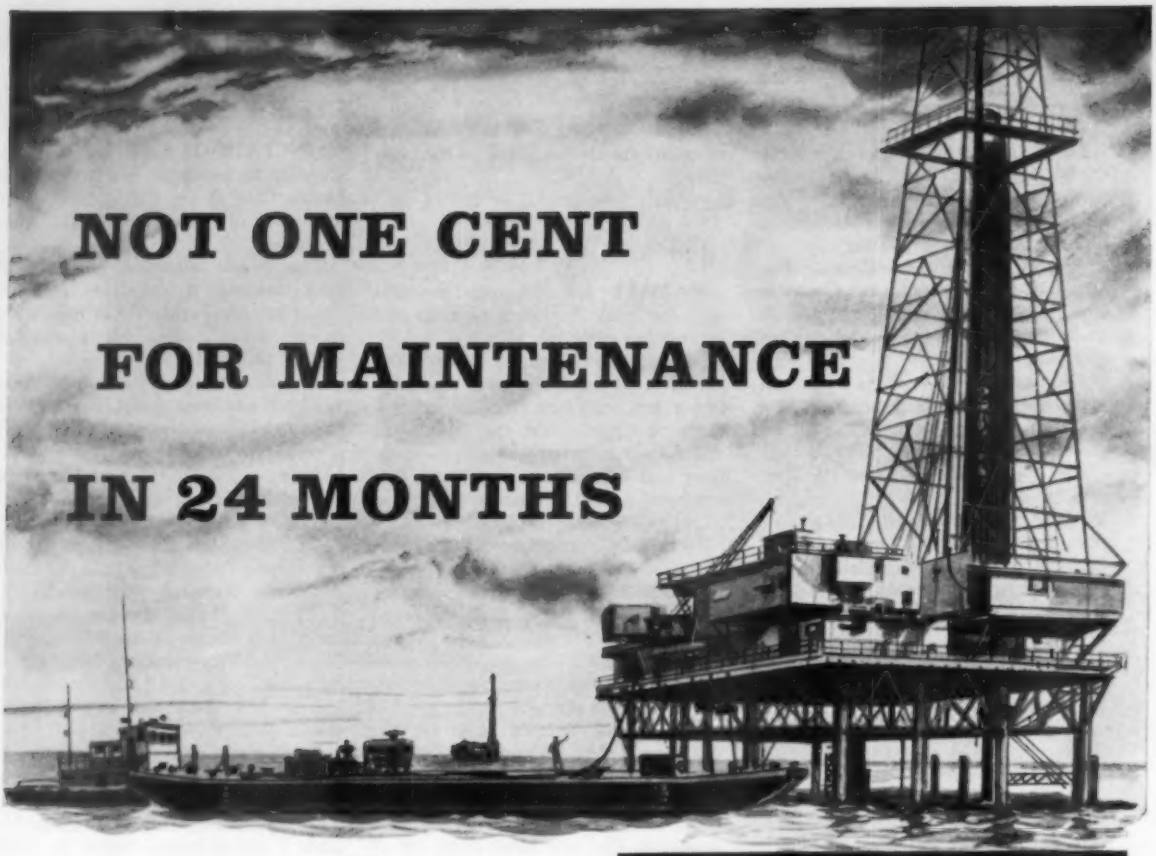
February 3, 1949

A 10.4 mile "steep inch" pipeline, with 60% grades, will be built by Creole Petroleum Corp. from Catia la Mar to Caracas. The $4,500,000 line will eliminate 100 daily tank truck round trips on a mountainous 20-mile road.

Shell companies earmark $24,000,000 for petroleum research in 1949.

Two offshore drilling structures, largest yet built with space for drilling one vertical and four deflected wells to 20,000-ft., are being fabricated for Gulf of Mexico use by Superior Oil Co.

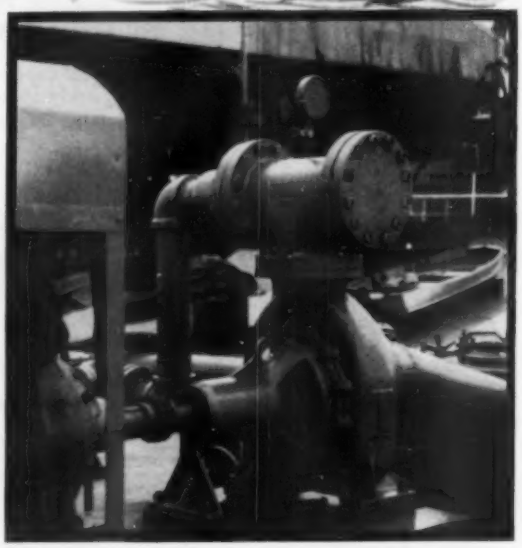
Senate small-business committee charges, after 22 hearings, that integrated companies dominate oil industry and are forcing independents out of business. It says companies control pipelines, pipe supplies, hoard tank cars, and will not farm out acreage.



Gorman-Rupp Model 06B-B Pump on "floating filling stations" gives outstanding performance for Petroleum Distributing Company

On tank barges that supply gasoline, diesel and fuel oil to storage for offshore drilling supply, Petroleum Distributing Company experienced unusual difficulty in keeping their positive displacement pumps operating. In a very brief time, pumps on one barge failed four times in a row. Mr. James George, Manager of Operations for the New Orleans branch, reports: "In the two years since placing Gorman-Rupp 'O' Series Pumps on the job, we haven't had to spend one cent on maintenance. Just one of these 6" pumps handles both loading and discharge for a 2500-barrel capacity barge. Now we can complete our delivery to offshore storage in less than a half-hour visit."

Ask our Gorman-Rupp distributor to show you these unique *centrifugal pumps that prime.* They have straight-in suction and no check valves.



Gorman-Rupp PUMPS

THE GORMAN-RUPP COMPANY

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Reef Pool Opened in Texas' Midland Basin

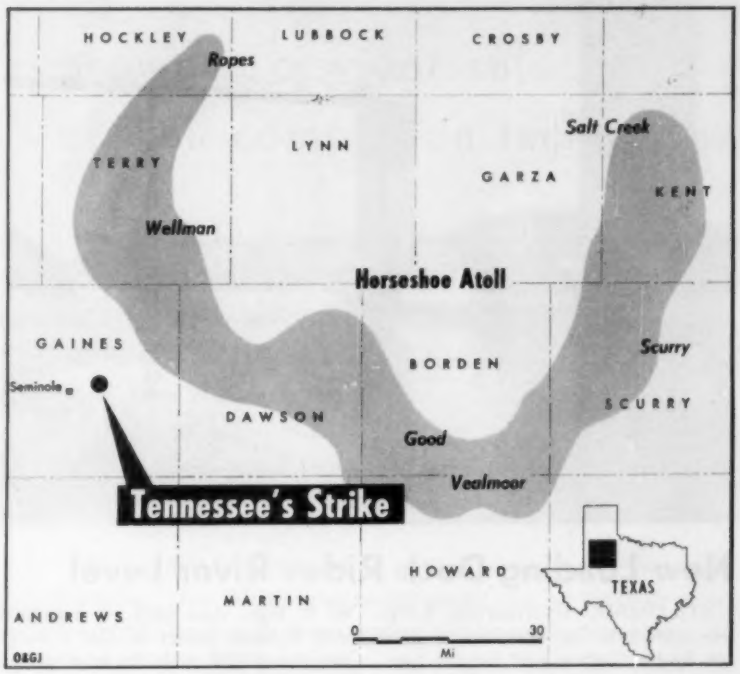
A WEST TEXAS wildcat has produced a heavy flow of oil on initial tests of a thick reef section. A net pay section of 55 ft. was reported.

The discovery is Tennessee Gas & Oil Co. 1 Kay Kimball "A," in Section 104, Block H, D&W Survey, about 13 miles east of Seminole in eastern Gaines County.

Operators identified the reef as biohermal reef, of Wolfcamp age. The well flowed oil at the rate of 44 bbl. of 27.7°-gravity oil an hour on drill-stem test at 10,350-10,435 ft.

Field sources reported the following drill-stem test results: At 10,136-10,277 ft. and at 10,279-10,319 ft. oil and gas were recovered in the drill pipe. At 10,319-69 ft. the well flowed 20 bbl. oil an hour to pits, under flowing pressure that ranged from 600-4,060 psi. At 10,399-10,429 ft. the well flowed 22 bbl. of oil in 30 minutes. These sections were identified as Pennsylvanian.

It's in the northwestern portion of the big Midland basin, about 15 miles southwest of the Horseshoe Atoll, the semicircle of Pennsylvanian reef fields.



Interior, NPC Hassle Ends

. . . with Carson being named government's cochairman of council. This year's agenda includes three studies.

THE NATIONAL Petroleum Council faces a busy year after settling its year-long feud with the federal Government.

By a vote of 66 to 1, council members yielded last week to federal demands that the Government be given a stronger official voice in NPC affairs. Changes in the articles of organization provide, among other things, for a salaried official of the Interior Department to serve as cochairman of the council. He has the right to call any council meeting to a halt "if he feels it is being improperly used."

Until last week, the council had balked repeatedly at government efforts to interfere in its operating procedure. Largely because of the disagreement, the NPC had not met since October 3, 1957.

Immediately after burying the hatchet with the Government, the NPC agreed to undertake three industry studies for the Interior Department. These include:

. . . **Review** of a mobilization plan drawn up by Interior to assure adequate supplies of petroleum products in a national emergency. The council will recommend industry personnel to fill key positions in the oil and gas emergency organization.

. . . **Updating** an earlier NPC report on the use of radio and radar in the Petroleum industry.

. . . **Determining** the available storage facilities of 25,000-bbl. capacity or more for crude oil and principal products. Facilities will be listed by state and county.

Officers elected . . . Walter S. Hallanan, president of Plymouth Oil Co., was elected to a fourteenth term as NPC chairman. All other officers also were renamed to their old jobs on the reorganized council.

Several members object to the proposed rule changes on grounds that they were a threat to the NPC's independence. However, Andrew S. Ritchie, Kansas independent producer, was the only one to vote against their adoption.

Victor Hansen, assistant attorney general, who had insisted on new controls over the NPC, pointed out that they would give the council legal protection against possible antitrust charges. Hallanan quoted Hansen as saying that in his opinion there had never been any activity by the NPC that violated the antitrust law.

J. Howard Marshall, Signal Oil & Gas Co., Fort Worth, expressed the view that the new rules formalized "what in fact we had been doing, anyway."

Government man . . . The new government cochairman, appointed by the Secretary of Interior, will be Capt. Matthew V. Carson, Jr.

Carson also serves as director of the Interior Department's Office of Oil and Gas and as administrator of the voluntary oil imports program.

Under charter amendents, committee appointments are subject to the approval of the cochairman. His concurrence also will be required before a council meeting can be called.

The cochairman or another salaried employe of the Interior Department will serve as cochairman of each NPC committee. The meeting agenda will be subject to his advance approval. Minutes of the meetings of both the council and its committees are to be made in duplicate, with one copy to be kept by the chairman and the other by the cochairman.

New Loading Dock Rides River Level

COLUMBIA Hydrocarbon Corp. has completed its Ohio River dock for loading butane and natural gasoline produced at its new $5-million fractionating plant at Siloam, Ky.

The dock includes two steel-sheet cells that are filled with sand and gravel and capped with cement. A walkway from shore runs to one cell. The walkway supports two 6-in. lines from Columbia's new plant that run down the side of the cell. There are loading facilities at 10-ft. intervals on this cell to permit loading regardless of the level of the river.

Both cells are 18 ft. in diameter and 60 ft. high. And both are equipped with H-beam guides so that a barge can rise or fall with the level of the river. The cells are 124 ft. apart.

About 2,250,000 gal. of products per month are loaded out from the dock for barge shipment to customers on the inland waterways. The dock is just across the river from Portsmouth, Ohio.

The fractionation plant and nearby LPG underground storage caverns are part of a $13-million project in this area by the Charleston Group companies. New shale storage caverns will hold about 290,000 bbl. of LPG.

Nuclear Plan Hit

by businessman. Value of shale blast is questioned.

OPPOSITION is developing to planned use of a nuclear blast designed to free oil from Rocky Mountain shale deposits.

Daniel J. Flood (D-Pa.), has asked the Atomic Energy Commission to investigate a report by Morgan G. Huntington, president of RNB Corp. of Salt Lake City, an atomic development company. If the report is true, Flood said, the AEC should cancel plans for the explosion.

The project, estimated to cost $2.6 million, is tentatively scheduled for western Colorado, near the Bureau of Mines' long-idle Rifle oil-shale demonstration plant.

Huntington claimed the proposed blast would create a huge crater, scatter millions of tons of radioactive rock over a large area, and reclaim no commercial oil. He also contended the atomic experiment would cost $10 to $15 million.

The Bureau of Mines, meanwhile, is attempting to generate interest of the oil and chemical industries in the project (OGJ, Jan. 12, p. 58).

"We hope to get their reaction within a month or so," said C. C. Anderson, chief petroleum engineer for the bureau in Washington.

The bureau is asking the two industries to put up $1.2 million to prepare the site for the explosion, drive a tunnel if necessary, drill wells, and make the thermal recovery of the oil from the blasted shale. The AEC would put up $1 million and the bureau $400,000.

INDUSTRY BRIEFS . . .

Production of motor vehicles in Western Europe came close to catching up with the U. S. last year. Final figures show West Germany produced 1,495,229, and France 1,127,754. Preliminary figures for Great Britain are 1,360,000, and Italy 400,000. This adds up to 4,382,983 cars and trucks, or 85% of the U. S. total of 5,113,736. Automotive News reports that the U. S. produced 4,244,021 passenger cars, and 869,715 trucks in 1958.

Shell is opening a new shallow oil field more than 15 miles from nearest other field in Texas' far-southwestern Maverick County. Its discovery well, 1 Keisling, has been completed as a 14-bbl., 38°-gravity oil-pumper from Navarro-Olmos sand at 1,585-90 ft. Location is 25 miles south of Eagle Pass, on the Mexican border. It is Shell's wildcatting debut to this county, and the first discovery in the county in more than a year, marked by the drilling of nearly 100 tests.

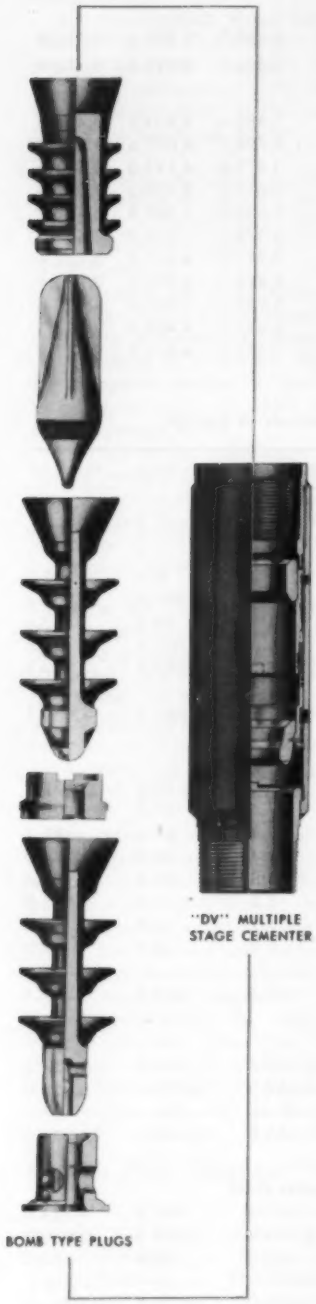
Sinclair has found oil pay at its 5 Ship Shoal Block 153, 30 miles off Terrebonne Parish, Louisiana. The discovery, just west of Gulf's Block 154 field, flowed 174 bbl. of 32°-gravity oil daily through 10/64-in. choke from Pliocene perforations at 6,311-24 ft. Sinclair is operator of the block, owned jointly with Sohio, El Paso Natural, and Peoples Production Co.

A water flood at Cat Creek field, Petroleum County, Montana, is expected to increase production from 120 bbl. to 2,000 bbl. daily. Continental plans to spend $2 million to flood 1,240 acres of the field's West and Main domes. Only the first and second Cat Creek sands will be affected. Water injection rate will be about 15,000 bbl. daily. The field has produced 16,500,000 bbl. of oil since discovery in 1920.

Deep South Oil Co. of Texas has purchased producing properties of Wright-Pinner Oil Co. and is taking over the Wright-Pinner offices in Houston. The properties consist of 27 wells producing 12,000 to 15,000 bbl. per month in Harris, Guadalupe, and Liberty counties in Texas.

MULTIPLE STAGE CEMENTING...

provides a wider selection of well completion techniques



Here are just a few advantages, when you complete your wells with Halliburton's versatile DV Multiple Stage Cementers:

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- **Cementing Off Formation at Any Pre-Determined Point**
- **Dual Zone Well Completion**
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Only one DV Cementer and set of plugs is required for two stage cementing... two DV Cementers and special plug set for three stage cementing. Tools with bomb type or displacement type plugs are available in tubing or casing sizes ranging from 2½" EUE to 13⅜" O. D.

Thousands of successful intermediate and production string cementing jobs have been completed with Halliburton's precision built differential valve "DV" Multiple Stage Cementers. Halliburton's unique tools incorporate a novel principle of hydraulics which allows precision placement and control... making it possible to effectively place more than one stage of cement on the outside of the same string of casing at selected points... in most any well regardless of depth, pressure or temperature.

See your nearby Halliburton Representative for the multiple benefits of Halliburton Multiple Stage Cementing.

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▶ ▶ ▶ Foreign News

Output Hits New Peak

. . . as free-world production zooms. Middle East dips, Venezuela, U. S., Canada, Argentina climb.

FREE-WORLD crude production edged upward in November for the second all-time high in 3 months.

Western Hemisphere producers accounted for the lion's share of the increase. Venezuela had its highest output in 16 months, and producers in both the U. S. and Canada had improvements.

Middle East production on the whole was down slightly. But two individual areas passed historic milestones. Kuwait Oil Co., operator in Kuwait for British Petroleum and Gulf Oil, produced more than 1.5 million barrels daily for the first time. In the Neutral Zone, where Aminoil and Getty Oil each has an undivided half interest in production, output passed the 100,000-bbl.-daily mark.

Another production record was in the making in Argentina, where output at the start of the month was well over 100,000 bbl. daily. In Italy, normal production of about 30,000 bbl. daily was down one-third because of a strike

TREND OVER THE LAST YEAR

	Western Hemisphere less U.S.	Middle East	Total Free World outside U.S.
1957			
November	3,660.7	3,697.4	8,151.5
December	3,661.7	3,973.6	8,412.4
1958			
January	3,680.4	4,034.0	8,465.6
February	3,798.7	4,057.6	8,662.1
March	3,672.6	4,243.0	8,631.3
April	3,613.5	4,109.2	8,528.0
May	3,582.9	4,087.8	8,468.2
June	3,678.0	4,156.8	8,654.2
July	3,777.0	4,247.2	8,832.6
August	3,828.4	4,334.0	8,971.5
September	3,769.8	4,535.2	9,120.8
October	3,891.3	4,482.3	9,177.5
November	4,051.2	4,472.1	9,319.8

World-Wide Crude Production: Daily Average in Thousands of Barrels

Country—	Nov. 1958	Oct. 1958	Nov. 1957
Middle East			
Bahrain	45.3	43.3	33.1
Iran*	811.0	816.0	712.0
Iraq†	781.8	817.4	604.1
Israel	2.0	2.0	1.2
Kuwait	1,504.6	1,494.1	1,107.0
Neutral Zone	104.6	99.1	83.5
Qatar	188.6	165.0	142.7
Saudi Arabia	1,034.2	1,045.4	1,013.8
Total	4,472.1	4,482.3	3,697.4
Other Asia			
British Borneo	104.6	104.6	113.3
Burma	10.5	10.5	7.4
India	8.5	8.5	7.6
Indonesia	320.0	320.0	349.4
Japan	7.0	7.0	6.4
New Guinea	5.6	5.6	5.6
Pakistan	5.9	5.9	5.9
Total	462.1	462.1	495.6
Africa			
Algeria	11.3	11.3	0.1
Angola	2.0	2.0	.....
Egypt	62.3	62.3	53.6
Gabon	11.3	10.8	5.2
Morocco	1.5	1.5	1.5
Nigeria	6.6	6.6	.....
Total	95.0	94.5	60.4
Western Hemisphere			
Argentina	107.8	107.8	97.9
Bolivia	9.1	9.1	9.4
Brazil	57.4	57.4	36.3
Canada	470.0	434.1	409.9
Chile	15.7	15.7	13.0
Colombia	135.2	133.8	127.0
Cuba	0.7	0.9	1.2
Ecuador	9.0	9.0	9.2
Mexico	269.0	269.0	251.6
Peru	54.3	54.3	53.4
Trinidad	106.8	104.6	97.0
Venezuela	2,816.2	2,689.7	2,554.8
Total	4,051.2	3,885.4	3,660.7
Europe			
Austria	51.2	51.3	58.1
France	27.5	27.5	26.9
West Germany	89.9	89.1	80.7
Italy	21.4	30.0	24.5
Netherlands	32.3	32.3	31.6
Turkey	6.5	6.5	5.9
United Kingdom	1.7	1.7	1.7
Yugoslavia	8.9	8.9	8.0
Total	239.4	247.3	237.4
Free World			
Foreign	9,319.8	9,171.6	8,151.5
United States	6,984.0	6,978.0	6,824.0
Total	16,303.8	16,149.6	14,975.5
Communist Countries in Soviet Orbit			
Romania	235.0	235.0	224.0
Russia	2,230.0	2,230.0	2,050.0
Others	60.0	60.0	50.0
Total	2,525.0	2,525.0	2,324.0
WORLD TOTAL	**18,828.8**	**18,674.6**	**17,299.5**

*Includes estimated 5,000 bbl. daily from Naft-i-Shah field not operated by consortium companies.

†Includes estimated 3,300 bbl. daily from Naft Kaneh field, operated until December by British Petroleum.

Figures are from reliable industry reports or government sources. Estimates are made where complete reports are lacking.

Oil Hits Coal Hard

in Europe as curbs on fuel shifts asked. Mines close.

EUROPE'S COAL industry is being pinched by competition from oil as never before.

Oil consumption has soared since World War II. But the increase was needed to power Europe's post-war industrial expansion. The coal industry marked time. It was, and still is, the backbone of Europe's energy supplies.

Oil markets have now grown to the point, however, where they are hitting the coal industry hard. This has sparked repercussions in Britain and West Germany.

In Britain, declining demand has forced the National Coal Board, which runs the nationalized industry, to order closing of 36 mines. The move has raised a storm in the miners union, some parts of which want to stage a protest strike.

Fuel oil is the chief cause of declining demand for coal. The iron and steel industries are steadily converting to oil, and home and offices are switching to oil as the result of a government campaign for clean air.

Germans act . . . In West Germany, the coal industry is in such bad shape that the government has imposed a voluntary plan to temporarily curb the growth of heavy fuel oil. Producers and importers are free to join the plan in about the same way that U. S. importers are free to join the voluntary imports program in the U. S.

The government is taking a personal hand in discouraging change-overs to fuel oil. It will refuse subsidies for the installation of industrial fuel oil heating systems. The oil industry has received one boon, however. Plans for a consumption tax on fuel oil have been dropped.

The government is emphasizing that its program is designed to give the coal industry a breathing spell. The growth of fuel oil sales over a long period will not be hampered.

English Find Deepest Pay

A NEW WILDCAT in England has brought in a better-than-average well from the deepest pay in the country.

Gainsborough 1 in Lincolnshire tested 110 bbl. daily from 4,600 ft. It is 1½ miles east of the town of Gainsborough, and 2½ miles west of last year's discovery at Corringham. The Corringham find is the next deepest pay in the country, producing between 4,385-4,433 ft.

Iran Gets 40,000-Bbl. Well

ONE OF THE world's best wells, if not the best, has been completed in Iran's Agha Jari field by Iranian Oil Exploration & Producing Co.

AJ-53 has flowed on test at a rate of 40,000 bbl. daily. The consortium company said this indicates a potential yield upwards of 50,000 bbl. daily on production. The well is 6,832 ft. deep.

Agha Jari, Iran's largest field, was discovered in 1937 and had 480,000 bbl. daily production last year.

Seven Firms Join To Explore Huge Australian Tract

OWNERSHIP in a budding exploration program in Australia's Great Artesian basin is unusually complex, even for the oil business.

Seven British, Australian, and American firms have a piece of a 110,000-sq.-mile concession on which three wells will be drilled in the next 2 years (OGJ, Jan. 12, p. 67). One of the tests may go to 14,000 ft. The first wildcat is expected to start before March 1.

Santos, Ltd., Delhi Australian Petroleum, and Frome-Broken Hill, Pty., each will have one-third undivided interest in the venture. The agreement will become binding as soon as Santos gives formal approval. Frome-Broken Hill will pay a major part of the exploration costs until a specific figure is agreed upon. Delhi Australian will be the operator.

Santos is a local public company. Delhi Australian is a subsidiary of Delhi-Taylor of Dallas. Frome-Broken Hill is owned one-third by Stanvac, one-third by British Petroleum, and one-third by Zinc Corp. and Interstate Oil. A Zinc Corp. subsidiary owns 50% of Interstate with the rest held by private investors.

Frome-Broken Hill has been joined in this particular deal, however, by American Metal Climax. The group, known as Frome Participants, breaks out with Stanvac holding 31%, BP 31%, Zinc and Interstate, 31%, and American Metal, 7%.

The venture is expected to benefit from a new Australian Government program to subsidize exploration drilling. But any government aid will be added to expenditures already planned. At least $2 million will be spent in the first 2 years, and possibly $10.7 million by the end of 1963.

Libya Find Tested

in lower sands. Results are poor as salt water appears.

THE FRENCH company that brought in a discovery in Libya last year has had poor results testing the same well further down hole.

Only a few barrels of oil were recovered from the Ordovician series tested by CPTL in its B.1. Block 49, drilled in the Fezzan Province near the Algerian border. The tests were made at about 7,573 ft., the extreme depth limit of the rig. The hole was bottomed after drilling through 33 ft. of Ordovician.

CPTL will now run production tests in Carboniferous sandstones further up hole. Twenty barrels of crude were recovered in a 2-hour test last September from 4,600-4,675 ft.

On the way down, the well encountered the Marine carboniferous series from 5,188-5,730 ft., Devonian series, 5,730-6,500 ft., and Gothlandian series, 6,500-7,540 ft. The well was then taken 33 more feet in the Ordovician.

The company said that tests run in the lower Carboniferous yielded an appreciable amount of oil with salt water. Only salt water was obtained from the Devonian. After the well was bottomed, new tests from "tournaisian" sands gave a relatively strong flow of gas and from 40 to 60 bbl. of oil. The well was drilled in a faulted area, which is under seismic study.

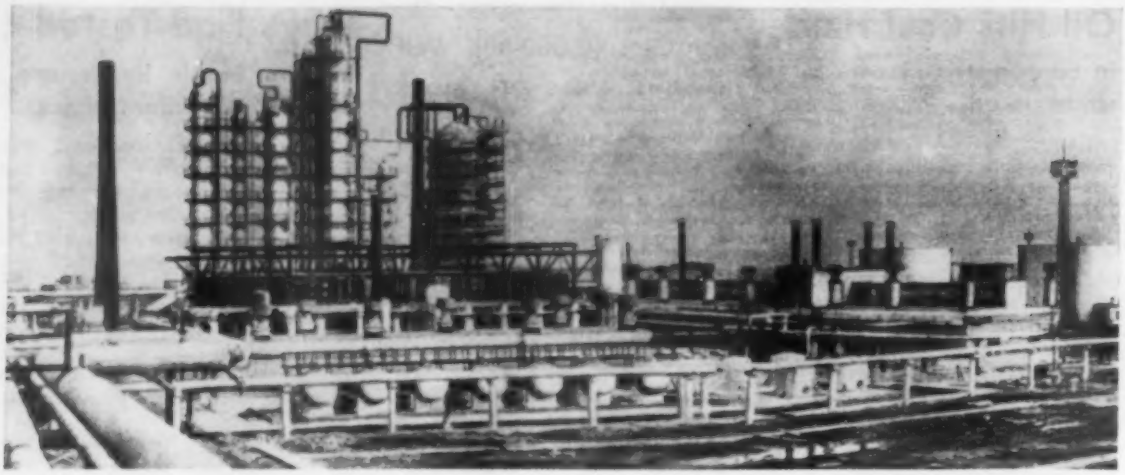
Iran Tanker Docks Planned

A NEW IRANIAN tanker terminal on the Persian gulf may be completed this year.

Construction contract for an $11-million port at Kharg Island has been awarded Richard Costain, in association with Raymond World Wide Constructors.

The terminal is part of an expansion program raising the productive capacity of the 31-year-old Gach Saran field from 59,000 bbl. eventually to 450,000 bbl. daily. It will be able to handle tankers of 100,000 tons. A steel pile jetty will extend more than ½ mile. A boat harbor will take tugs and other small vessels.

Contract was awarded by Iranian Construction Group, which is supervising the Gach Saran expansion for the consortium's Iranian Oil Exploration & Producing Co. Other parts of the program include a 90-mile pipeline—26-in., 28-in., and 30-in.—to the terminal from Gach Saran. Twenty-three miles will be under water.



Large Russian Refinery at Perm on Stream

IF RUSSIA'S ex-bigwig V. M. Molotov hadn't been sandbagged in the Kremlin political game he would now have the country's newest and one of its largest refineries named in his honor.

The plant has gone on stream at Perm, capital of Perm Province, nestled against the Ural Mountains on the northern edge of the second Baku crude-producing region. No throughput capacity figures have been given, but the Russians say the refinery is one of their biggest and is highly automated.

Feed for the plant will come from local fields, where important new discoveries continue to be made both near the capital and along the southern border of the province. One well in a new field at Ilinskoe, 40 miles northwest of Perm, has been completed for more than 1,000 bbl. daily.

Crude supplies also will be drawn from Bashkir and Tatar areas to the southwest. All crude delivered to the plant will be carried by pipeline.

The city and province of Perm for years were known as Molotov. But when the first deputy premier and ex-foreign minister was ousted from Kremlin leadership in 1957, the original name was restored.

WORLD BRIEFS...

Russia will use 40-in. pipe in a natural-gas pipeline system from new fields near Bukhara, Uzbekistan, which they say are the world's largest. Survey work on parallel routes is under way to Ural mountains, metallurgical centers at Chelyabinsk and Sverdlovsk (OGJ, Oct. 20, p. 72).

Two new rigs rated at 8,500 ft. have been placed in operation in Iraq by Drilling & Exploration, Ltd., of London, subsidiary of Drilling & Exploration Co., Inc., Dallas. The Ideco equipment will be used in drilling for Iraq Petroleum Co.

Plymouth Oil Co. of Pittsburgh is joining the Australian exploration play. It has reached an agreement with the government on 29 million acres, most of it on Cape York Peninsula north of Cooktown, Queensland.

United Carbon Co. has acquired 51% capital-stock interest in Argus Petroleum Corp., which holds 728,000 acres of concessions in Guatemala. The purchase was made from Husky Oil Co., which retains 9.69% net-profit interest in any future production from Argus properties. Argus was formed 2 years ago to acquire Guatemalan acreage.

Location has been staked for a wildcat to be drilled soon on North Island, New Zealand. Shell-BP-Todd Oil Services will drill the test 11 miles from Hawera on the West Coast of the island. A rig is being brought in from British Borneo.

Happy days are here for Lorraine-Escaut, a leading French steel manufacturer. The firm has been awarded a contract for three-quarters of the pipe needed for the 470-mile, 24-in. crude pipeline from CREPS' fields in Algeria to the Mediterranean. Before deliveries of 38 miles of pipe per month begin in May, the firm will produce 125 miles of pipe for the Lacq-Paris natural-gas system. It also is making pipe for the 24-in. line from Hassi Messaoud field in the Sahara.

A $250,000 wildcat drilled below 5,000 ft. in the Hebron area of Jordan by Phillips Petroleum Co. has been abandoned as a dry hole. A new test at Siwaileh is to start immediately. Phillips acquired a 90.4% interest in a concession over one-third of the country from Edwin W. Pauley last year.

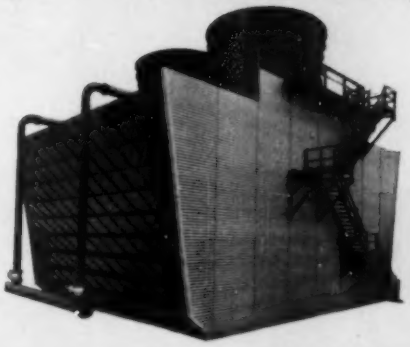
Drilling in Venezuela fell off by more than one-third last year. There were 1,090 wells completed or abandoned, including 180 wildcats, and 910 other wells. Another 60 wells were suspended. The total in 1957 was 1,828 wells.

Eastern Siberia will be swarmed by a record number of survey parties in 1959. Many teams will operate in areas never before covered by geologists. These include Khabarovsk territory of Sakhalin Island and the Kruile Islands.

1958 TOWER TESTS

Marley's 3rd Annual Report to Industry

The day of "hazard buying" of cooling towers is past. To substantiate this, Marley encourages purchasers to TEST YOUR TOWER and each year publishes the results of these tests. This list of tests is not selected or edited—it is a consecutive record of ALL tests of Marley Cross-Flow towers during 1958. Seventeen tests were conducted according to accepted test code procedure—*more than reported by all other manufacturers combined.*



TEST NO.	TYPE OF SERVICE AND LOCATION	SPECIFIED CONDITIONS				TEST RESULTS	
		Gallons Per Minute	Hot Water Temp.	Cold Water Temp.	Wet Bulb Temp.	Degrees Cold Water Temp.	Percent Capacity
1*	Petroleum Refinery—North Central	5,200	120°	84°	74°	+0.44°	+3.5%
2*	Chemical Process—Mountain States	7,000	90°	75°	65°	+0.65°	+7.2%
3*	Power Plant—West Coast	31,500	109.4°	91°	80°	+0.35°	+2.6%
4†	Petroleum Refinery—Gulf Coast	28,000	113°	93°	82.5°	+0.37°	+2.9%
5†	Petroleum Refinery—Gulf Coast	16,000	112°	91.5°	82.5°	+1.50°	+9.6%
6*	Power Plant—Mid-Central	14,750	102°	87°	75°	+0.40°	+3.1%
7	Petroleum Refinery—Gulf Coast	25,000	120°	95°	82.5°	−0.30°	−2.0%
8†	Power Plant—Mid-Central	7,000	96°	85°	75°	−0.05°	−0.5%
9*	Petroleum Refinery—North-Central	9,300	110°	84°	74°	+0.40°	+3.0%
10	Power Plant—Mid-Central	9,500	100°	86°	75°	+0.10°	+0.8%
11†	Power Plant—Mid-Central	16,000	102.2°	90°	75°	+0.30°	+2.0%
12†	Petroleum Refinery—Mid-Central	23,250	106.5°	88.5°	77°	+1.60°	+12.6%
13	Power Plant—Mid-Central	60,000	99°	84°	74°	+0.30°	+3.1%
14†	Petroleum Refinery—Gulf Coast	45,000	112°	89°	82.5°	−0.54°	−5.2%
15	Petroleum Refinery—Gulf Coast	6,000	115°	85°	79°	+0.30°	+3.6%
16	Air Conditioning—Mid-Central	4,200	96°	85°	78°	+0.30°	+3.5%
17*	Power Plant—Mid-Central	44,000	99.5°	86°	74°	+0.80°	+7.2%
18†	Power Plant—Southwest	61,500	106.5°	88.5°	76.5°	+1.20°	+11.0%
19*	Petroleum Refinery—East-Central	8,000	115°	85°	75°	+0.50°	+4.0%
20†	Petroleum Refinery—Gulf Coast	57,500	120°	85°	79°	−0.03°	−0.03%
21	Petroleum Refinery—Gulf Coast	18,830	112°	85°	79°	+0.14°	+1.5%
22†	Petroleum Refinery—Gulf Coast	34,000	113.5°	87.5°	80°	+0.12°	+1.2%

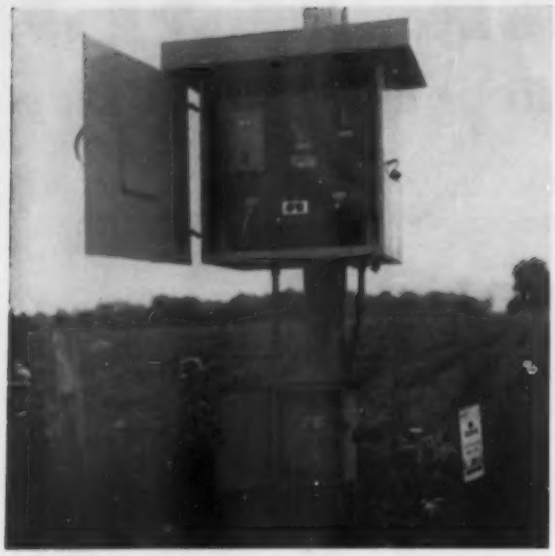
*Code Test (observer not present) †Code Test (observer present)

Here is positive proof of "in service" performance—the strongest possible assurance that Marley towers are bid and built to equal or exceed specified performance. If you believe with Marley that every industrial tower owner is entitled—if not obligated—to know the capability of his tower, before and after installation, write today for these Marley technical bulletins: "Analyze Your Bids" and "Test Your Tower."

MARLEY

The Marley Company

Kansas City, Missouri



POLE-MOUNTED rectifier unit is shown with lower box containing shunt for measuring current from each of the two pipelines connected to unit plus fittings for resistors.

D.C. OUTPUT of rectifier is periodically checked with this meter. When plug is inserted into receptacle, voltage and amperage can be read simultaneously.

Rectifiers protect bare pipeline

. . . on Standard of Ohio's products system

BY L. H. WEST
Standard Oil Co. (Ohio)

Almost half of Sohio's high-pressure products pipelines are bare. The author, a corrosion engineer for Sohio's products-pipeline division, tells here how cathodic protection of 206 miles of the bare pipe is expected to save about $1,000,000 over and above the initial investment and operating expense in the first 5 years. West, who has been active in pipeline corrosion-control work for 12 years, bases his calculations on projection of leak-expectancy curves.

SOHIO operates approximately 650 miles of 4 to 10-in. welded steel pipelines, which are used to ship products between 4 refineries and 16 terminals in Ohio. Products vary from butane to heavy cracking feed, and the operating pressure at discharge from pumps is in the vicinity of 1,000 psi.

Forty-five per cent of the pipe in the system is bare. Multiple (looped) lines extend between several points, and approximately 120 miles of right-of-way contains one bare and one coated line in parallel ditches—just a few feet apart.

External corrosion of the bare steel pipe (vintage 1937-38) has, in recent years, become a problem. The average cost of individual corrosion leaks in these pipelines is from $2,000 to $2,500. This expense includes product loss, lost pumping time, labor and equipment costs, and damages.

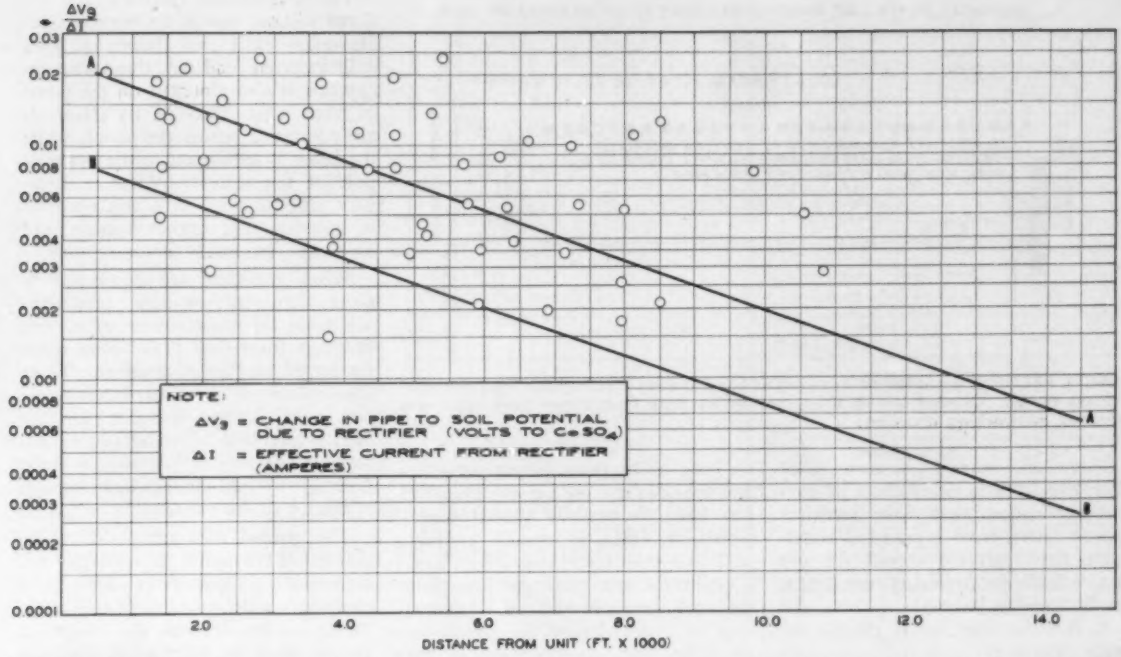
Galvanic corrosion is the main problem. However, stray d.c. currents are prevalent in the Dayton and Cleveland areas. It is further estimated that bacteriological attack is responsible for from 10 to 20% of the active corrosion. Occasionally, interference currents from other companies' protective systems are encountered.

Mitigation of interference current is usually a matter of interconnecting structures, through the mutual cooperation of those involved. The several coordinating committees in Ohio are a great aid in such situations.

Corrosion Mitigation Study

Cathodic-protection current requirements from rectifiers connected to coated sections of pipeline are, of course, comparatively small, so that there is no serious question of economics. On the other hand, when considering the troublesome bare 6 and 8-in. structures, the following alternates were studied:

1. Reconditioning and coating plus supplemental cathodic protection.
2. Replacement with coated pipe plus supplemental cathodic protection.
3. Partial cathodic protection of existing bare pipe.
4. Complete cathodic protection of existing bare pipe. (Either through application of current to entire sur-



ATTENUATION CURVE shows data taken from the point of current application at five different locations along the line. Curve B-B can be used for estimating maximum current requirements; A-A is an average.

face, or localized application at anodic areas.)

Alternates 1 and 2 were quickly eliminated because of their long payout period (large capital investment required). Alternate 3 was not used either, because it was not believed possible to select any appreciable length of line free of corroding areas.

Soil resistance varies from well over 100,000 ohm-cm. to 1,000 ohm-cm., and some of the earliest corrosion failures had occurred in soils of above 20,000 ohm-cm. Potential surveys indicated anodic areas of various lengths (5 to 500 ft.) distributed fairly evenly throughout the entire length of right-of-way. Also, corrosion failures were not confined to any definite sections.

Alternate 4 was selected. It was assumed that application of current to the entire surface of the pipe through the use of rectifiers would be 95-100% effective, while protection of individual anodic spots would be 80% effective (using galvanic anodes).

Although the galvanic anodes may, in some cases, be considered an operating expense, the superior effectiveness of capitalized rectifier units gives these the advantage. Therefore, it was finally decided to consider galvanic anodes only in those areas where the number of foreign structures (buried) crossing our bare lines exceeds one or two per mile, or where a parallel configuration exists.

During 1957-58, an extensive rectifier-installation program, aimed at leak reduction in the older bare lines, was undertaken. Some 104 miles of single, bare 6 and 8-in. line plus 102 miles of bare 6 and 8-in. line looped by a coated 10-in. are involved.

Rectifiers are being installed for protection of the bare pipelines where interference to foreign structures is not a major problem. This means that they cover approximately 140 miles, or 68% of the pipe. The remainder of the bare pipe is protected by magnesium (galvanic) anodes connected at anodic "hot spots" located by survey.

Our past experience with rectifiers as a source of current supply for bare-pipe protection indicates that 95-100% effectiveness in reduction of corrosion failures can be expected, and this system is therefore economically justified. We assume, however, that failures will continue to occur during the first year following the time the rectifiers are turned in.

RECTIFIER OPERATING RECORD

Line_____ Mfgr._____

Location_____ Model_____

Station No._____ Serial No._____

Date Turned On_____ Type_____

Stacks, Type and Mfgr._____ Fuse, Size and Type_____

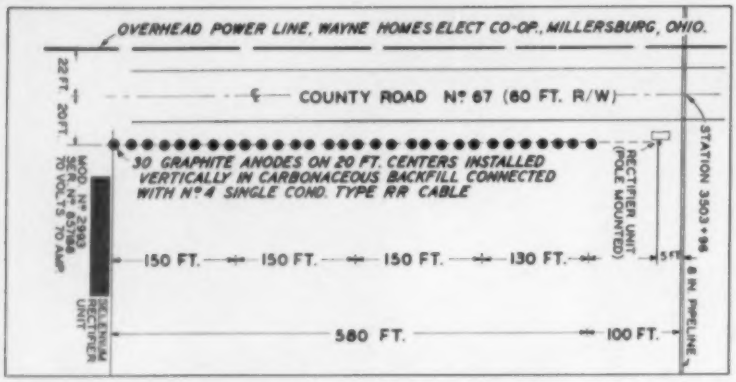
Remarks_____ Switch, Size and Mfgr._____

_____ Ammeter_____

Voltmeter_____

Date	Found Volts D.C.	Found Amps D.C.	Adjusted Volts D.C.	Adjusted Amps D.C.	Power Meter RPM	Power Meter Factor	Efficiency	Power Meter Reading	Remarks	Tested By

PERFORMANCE RECORD of each rectifier unit is maintained.


OVERHEAD POWER LINE, WAYNE HOMES ELECT CO-OP., MILLERSBURG, OHIO.
22 FT.
20 FT.
℄ COUNTY ROAD Nº 67 (60 FT. R/W)
STATION 3503+98
30 GRAPHITE ANODES ON 20 FT. CENTERS INSTALLED VERTICALLY IN CARBONACEOUS BACKFILL CONNECTED WITH Nº 4 SINGLE COND. TYPE RH CABLE
RECTIFIER UNIT (POLE MOUNTED)
MOD. Nº 2983 SER. Nº 63788 50 VOLTS 70 AMP.
SELENIUM RECTIFIER UNIT
150 FT.
150 FT.
150 FT.
130 FT.
5 FT.
8 IN. PIPELINE
580 FT.
100 FT.

TYPICAL RECTIFIER installation drawing is used during construction and for permanent record. Ground bed and soil resistance data (not shown here) also are recorded on working drawing.

There are several reasons, other than effectiveness of method of current application, that make rectifiers appear better, from a practical standpoint, than galvanic anodes for use in a cathodic-protection system. These can be listed as follows:

1. Routine operational checks are easily obtained.
2. Information from relatively few check points gives data on the entire system.
3. A rectifier system is less susceptible to construction damage (looping, etc.) because connecting cables are used at fewer locations.
4. Current output can be adjusted to almost any value desired.
5. Current requirements can be practically estimated from the relatively few points where rectifiers are installed.
6. Rectifiers can be used to protect more than one line located on the same right-of-way. (Example: New coated loop lines can be tied into an existing system without any appreciable changes.)

On the other hand, disadvantages of this type system can also be listed:

1. Rectifier installations always necessitate investment of capital funds, while galvanic anodes may sometimes be expensed.
2. Interference with foreign structures must always be a consideration.

Design of Rectifier Installations

Five major considerations have dictated the location of rectifier units along our bare pipeline system:

1. Theoretical spacing point (based on economical balance between power and capital costs.)
2. Location of foreign structures.
3. Power availability.
4. Soil resistivity.
5. Right-of-way availability.

Theoretically, it would be most economical to use a very close spacing between units. However, in order to keep away from the construction and maintenance of power lines, this has been limited by power supply which, in Ohio, is usually available at 2 to 4-mile intervals.

Soil-resistance readings throughout the area then give sufficient information to pinpoint possible ground-bed locations, and an easement is purchased at one. Of course, the presence of buried pipelines or cables in any location will eliminate the possibility of its use as a ground-bed site, and make it necessary to consider alternates.

Standard commercial air-cooled selenium rectifiers (pole-mounted) are used. Their size ranges from 25 to 60-amp., d.c. output. The ampherage output is, of course, dependent upon the spacing and attenuation from the selected point. An attenuation curve composed of data taken from five points along our bare 8-in. pipeline is shown. This is used as a guide in sizing units without preliminary tests at each location.

The required d.c. voltage, which depends upon external circuit resistance, is actually a function of the ground-bed resistance. We attempt to achieve a ground-bed-to-pipe resistance of 1.0 ohm through the use of H. B. Dwight's ground-resistance derivations (Elec. Eng., Dec. 1936) along with four-pin soil-resistivity data. Results have been satisfactory in that the average circuit resistance of the 29 beds installed in the 1957 program is 0.90 ohms.

Actual current ratings of rectifier units installed is slightly larger than estimated requirements. Hence possible interference drainage and seasonal variations in external circuit resistance will not "upset" the system. In the same way, some extra voltage is available in the units so that reasonably uniform current output can be maintained, even as rectifier stacks age and circuit resistances increase.

The commercial rectifiers are ordered without meters on the d.c. side. However, 0.001-ohm shunts are used with external leads. A three-wire receptacle is also mounted on the panel of each unit. Two of its terminals are connected across the shunt, while the other is connected to the opposite pole of the rectifier. When a three-wire plug attached to a volt-ammeter is inserted, d.c. output voltage and amperage are read simultaneously.

When rectifiers are connected to more than one pipeline, provisions are made for measurement of current drainage from each (0.001-ohm shunt connected into negative return). These connections are contained in a separate box with fittings installed for the future insertion of standard-size adjustable resistors, if it is later thought desirable to limit current flow through either leg of the circuit.

The ground beds are placed at locations where power is available, soil resistance comparatively low (also preferably permanent moisture), easements can be obtained, and which are spaced along the line to give adequate coverage with minimum current requirements.

Graphite (size 3 by 60 in.) or high-silicon cast iron (size 1½ by 60 in.) rods are used as ground-bed material. These are installed vertically in 9-ft. holes, 8 in. in diameter. Coal coke-breeze backfill is tamped around them, and to within a few inches of the top of the ground. These anodes are usually installed on 20-ft. centers in a straight line. However, ground-bed configuration always conforms to special soil or right-of-way conditions. In some cases of rocky terrain, construction difficulties dictate horizontal anode installation.

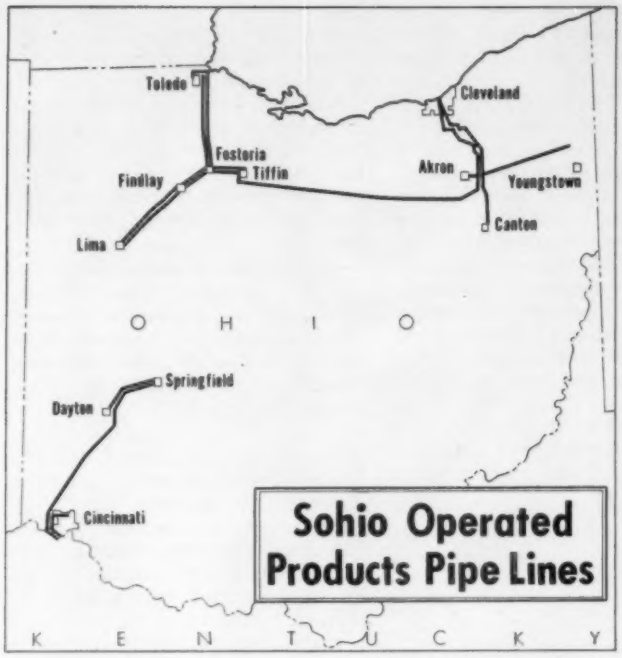
Based upon the economics of power loss vs. initial investment, No. 4, No. 2, or 1/0 direct burial cable is used for the underground wiring. Connections are thermite-welded. These are first coated with electrical putty followed by plastic tape and coating.

Site Selection and Installation

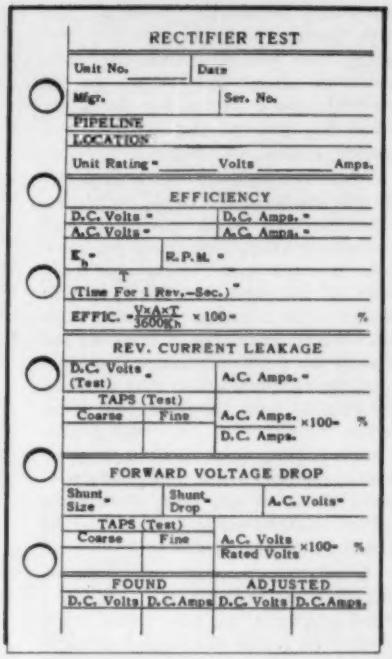
The installation of 29 rectifier units in 1957 and an additional 31 in 1958 (including site selection) meant that "production-line" planning was initiated so that costs could be trimmed and work completed on schedule during good weather.

Preliminary surveys were first run to gather information on the following right-of-way conditions:

1. Location of power supply (also name and address of company).
2. Location of foreign structures (also owner and owner's address).
3. Soil-resistance data and sketch of possible ground-bed locations.



SOHIO PRODUCTS lines, about half of which are bare, connect 4 refineries and 16 terminals in Ohio.



RECTIFIER TEST RECORDS are easily filed in field notebook.

Power lines which could possibly be used to serve rectifiers are plotted on maps, along with the location of foreign pipelines and buried cables. Foreign lines are located by examining records, cooperation promoted through local coordinating committees and actual field trips along the right-of-way.

Analysis of this information results in location of tentative rectifier sites. Soil-resistivity measurements are next taken throughout their general area, with special emphasis on likely spots of permanent moisture. The four-pin method of survey, with pins on 10-ft. centers, is used. Sketches, showing each locality, are drawn up in the field. These indicate:

1. Location of soil-resistance measurements.

2. Relative position of roads, power lines, fences, trees, houses, property lines, etc.

3. Property owners' names and addresses.

Drawings of proposed rectifiers are now made using field notes as a guide. Every effort is made to place ground beds, poles, etc., so that they will not inconvenience or be objectionable to property owners. Poles are usually placed in fence lines while rows of anodes are laid out a few feet away from field lines, and installed parallel to them.

Other items which are also considered in the drawings are possible installation or construction difficulties at the proposed location, and also future development of the area. An inaccessible location will increase costs and make future maintenance troublesome. Highway-modernization programs and housing developments can mean that the unit will have to be relocated or modified later on.

The right-of-way agent is furnished with copies of the completed drawings. He obtains easements on an option basis until final arrangements for service have been made with the local power companies. At that time, checks are mailed to property owners, and construction can begin.

It is sometimes necessary to lay out a rectifier on three or four alternate locations and/or to rearrange bed configuration before an easement is finally purchased. In a few cases, it has been necessary to assist a power company in obtaining right-of-way for a line extension.

Installation work is done by crews assembled especially for this seasonal work. The foremen of these crews also run surveys and maintain the cathodic-protection equipment.

A set of drawings of each rectifier is given the foremen, and they are familiarized with the locations, right-of-way restrictions, etc. A crew, or crews, consisting of three or four men then set out to install poles and pipe (negative return) connections at all rectifier sites.

After this first phase has been completed, larger crews (10 to 15 men) are assembled. The rods and buried connecting cables are now installed.

Generally, all earthwork, boring of anode holes, and ditching, is done by hand. One crew, working under normal conditions of weather and soil, can install a complete ground bed consisting of 25 to 35 graphite or iron rods complete with connections in a working day of 9 to 10 hours. The 8-in. anode holes are augered to a depth of 9 ft., and all ditches containing buried cable and connections are at least 2 ft. deep.

Coke-breeze backfill is hand-tamped around the carbon or iron anodes, and each hole is filled with this material to within a few inches of the top of the ground. The vertical holes are first augered. As they are completed, anodes are installed. Thermite connections are made to the header wire as it lies on top of the ground. As crew members complete the augering, they begin ditching.

Cable is next placed in the ditches and backfilled. Sufficient slack cable from both the ground bed and pipeline is coiled around the pole so that it will not be necessary to splice later on when the rectifier is mounted and connected.

Pipe-to-ground-bed circuit resistance is measured soon after beds have been installed. We recognize that this is usually somewhat higher (10 to 20%) than later readings taken after backfill has settled and become more

completely moistened. However, this does permit more accurate rectifier sizing than use of preliminary soil-resistance data, and allows us to promptly place orders for the units since the required d.c. voltage and current output is known.

When the rectifiers have been received, smaller crews made up of two or three men begin mounting and connecting them. Sometimes one crew goes through first bolting the rectifiers to the poles and installing guy cables, while a second follows through with the electrical connections. In the meantime, power companies have been again contacted so that we have information on the direction from which their services are coming, necessary guying, inspection, and other special considerations. The power people are also, at this time, given more complete information on load and estimated date of activation.

Since operators of other buried structures throughout the area have been contacted, we now know which companies prefer cooperative interference tests immediately at the time the rectifiers are turned on. Also, it is assumed that any railroads using signal circuits would want tests at the time of activation. As soon as power is made available, these interested parties are notified, meetings scheduled, and tests begun.

After each rectifier has been adjusted to the desired output, an interrupter is connected into the primary circuit so that on-off readings can be observed on all structures involved. Rectifiers are set at 10% or 20% below rated current output. This gives some allowance for seasonal variations in circuit (ground-bed resistance. The current output of new rectifier installations is observed very closely for the first few weeks after they have been turned on, with special attention after a heavy rainfall or similar situation which could overload the units.

Interference tests are continued, and any necessary bonds installed immediately. A standard bond box containing a panel upon which is mounted a 0.001-ohm shunt and brackets for a 1, 2, 3, or 5-ohm, 400-watt adjustable resistor is used. When interference work has been completed, tests are conducted along the protected line to determine final effectiveness.

Simultaneous with interference and adjustment tests, the rectifier ground-bed installation crew (now reduced in strength to five or six men) is used to clean up rectifier sites. They return to all locations at least twice to add misplaced fill dirt to the "settled" ditches. We find that this drastically reduces damage expense and increases property-owner satisfaction. Damage claims from property owners are usually settled for from $10 to $20 per rectifier installation.

One of the big advantages to the use of hand labor for rectifier installation is its effect on the property owner-company relationship. This is reflected in damage and easement costs, and even in making it possible to work at some locations where the land owner would refuse any arrangement bringing mechanized equipment on his farm. Above-ground damages to crops, fences, etc., are minimized as is breakage to drainage tile.

The average total cost (capital expenditure) for a single rectifier installation in the 1957 program is $2,400. A breakdown of the items involved in a typical unit is shown below:

Rectifier unit	$650.00
Graphite anodes	320.00
Coke-breeze backfill	101.00
Direct-burial cable	124.00
Underground connections	39.00
Pole	15.00
Misc. mat'l. and fittings	70.00
Labor	504.00
Travel expense	34.00
Vehicle	41.00
Easement	100.00
Damages	20.00
Overhead and service fees	132.00
	$2,150.00

This is a rectifier rated at 60-amp., d.c. output with a 35-anode ground bed. This is one of our largest units, and is used where right-of-way, power, and/or suitable soil conditions dictate a 4 or 5-mile spacing between rectifiers on bare pipe.

Operation and Maintenance

Sohio is at this time operating 64 rectifiers connected to the bare sections of the products pipelines it operates.

A monthly inspection of each rectifier is being made at present by operating personnel in each respective area. Readings are taken from the power meter, and also d.c. output current and voltage. All this information is tabulated on one sheet, and submitted at the same time each month. A number is assigned to every rectifier so that reference to the individual units can easily be made.

An operating record sheet for each rectifier is also maintained. This is used for recording tests and/or inspections made by corrosion section personnel, along with name-plate data and extra equipment associated with the rectifier. Rectifier-test-form pads are also used by field personnel to record data of field tests. This includes information pertinent to efficiency, reverse current leakage, and forward voltage drop.

Upon completion of the major part of the cathodic-protection program, it is anticipated that a routine check of protection afforded to the pipelines will be made at least once a year. Also, regular rectifier inspection will probably be made by corrosion-section personnel once each month.

Rectifiers are operated at direct current outputs slightly below their rating. Fuses are installed at the a.c. service entrance only. Fuse size, however, is close to the actual operating load of each unit. Lightning protection has not been used.

To date, we have had no failures in the 33 selenium rectifiers installed last year, most of which have been in service for approximately 1 year. Three experimental rectifiers with silicon diode rectifying elements which were placed in service in 1956 have, on the other hand, been a source of repeated trouble.

Interference tests were conducted, and in some cases resistance bonds have been installed. Ten mutual drainage points, where connections have been made to foreign pipelines and buried cables, are involved with rectifier units installed in 1957. Their combined drainage is 0.76% of the total applied protective current.

Past experience with cathodic protection of shorter sections of bare pipelines having leak records shows that the effect of such a program on corrosion failures is not seen until the cathodic protection has been on and operating 1 year.

This means that it takes 2 years to see the change in slope on a leak-frequency curve. Therefore, we are not yet in a position to show graphically the effect of our 1957-58 program. However, the number of corrosion failures experienced this year, to date, is already 30% less than that of the same period in 1957.

Annual operating cost (power) of the rectifier units connected to bare lines mentioned in this discussion varies from $800 for larger, widely spaced units to $120 for small units placed close together and in favorable soils. However, based on 90%-effective corrosion control, it is estimated that savings of about one million dollars will be realized for the period 1957-1962. This is based on leak-expectancy curves projected from past experience, both with and without protection. The difference for any year or period of years is then available, and can easily be converted to dollars. Cathodic-protection costs are finally balanced against actual reduction in line-repair expenses.

PACKER IS STARTED IN HOLE by Gene Cariker and Joe Simpson in an unusual test procedure on the 1-EE University well in Pecos County, Texas. Because of the extreme depth . . .

Phillips used caution in testing deep well

A DIFFERENT TECHNIQUE was used by Phillips Petroleum Co. for the first test in its 1-EE University well, world's deepest hole. The 4½-in. Halliburton Type "C" production packers were used to isolate a zone from 24,897 ft. to total depth of 25,340 ft. This zone was treated and tested through perforations in the 5-in. liner, which is suspended 16 ft. off bottom.

Deepest test . . . No tests, whether with production packers or conventional drill-stem methods, have ever been made at this depth.

Phillips engineers were aware of the hazards in working in such a deep hole, and decided to use precautionary measures in testing zones for possible production.

Joint effort . . . Halliburton tool engineers and Phillips representatives reviewed hole conditions and expected packer performance before operations were started. The first packer required a little over 13 hours to run and set. Rate of descent was 30 seconds per 90-ft. stand in the 7 and 7⅝-in. casing to the top of the liner at 22,682 ft. In the 5-in. liner, the rate of descent was reduced to about 1½ minutes per 90-ft. stand.

Each treble stand of pipe was measured individually to insure proper setting position for the packer.

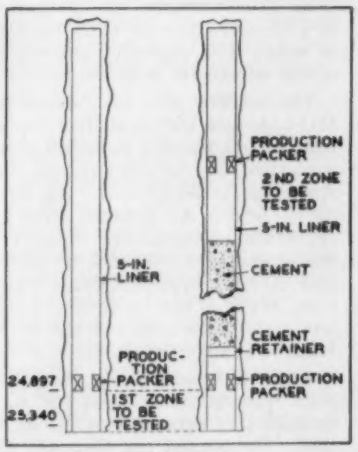
In the Type "C" packer, setting is accomplished by rotating the pipe about 25 times and pulling upward on the string. In this job, about 45 revolutions were used to be sure that the slips were released, because of the extreme length of the setting string. Pipe was then pulled upward with a force of 15,000 lb. to set the packer. Total weight of the pipe string plus setting pull was 325,000 lb.

Insurance . . . A second packer, located about 6 ft. above the first one, was run as a safety measure. It was run and set in a similar manner, without incident.

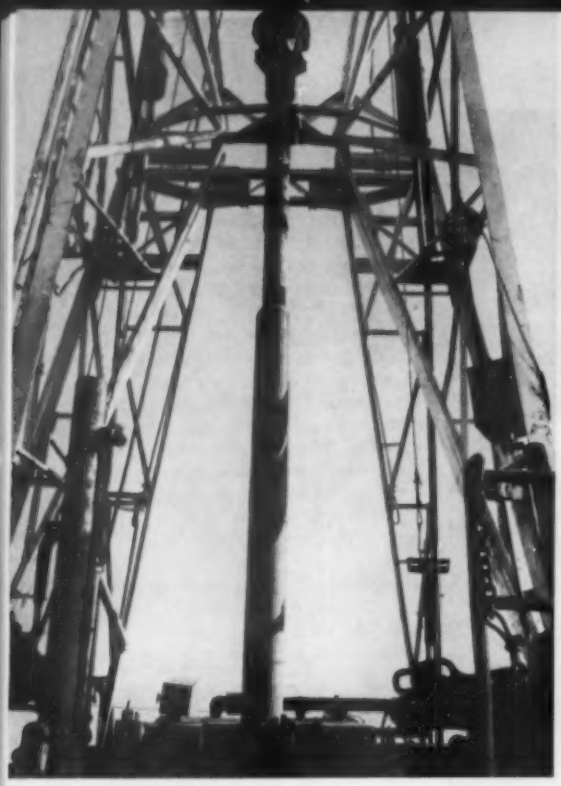
The two packers were subjected to extreme conditions as Phillips tested and treated the bottom zones. This included loading and circulating drill pipe to surface with fresh water and diesel oil, swabbing jobs to 11,000 ft., pumping oil into the formation and acidizing at about 10,000 psi. The temperature at the bottom of the hole was 320° F.

Plug back . . . On completion of the tests, Phillips decided to abandon the lower zone, plug back, perforate above, and continue testing higher zones in the same manner.

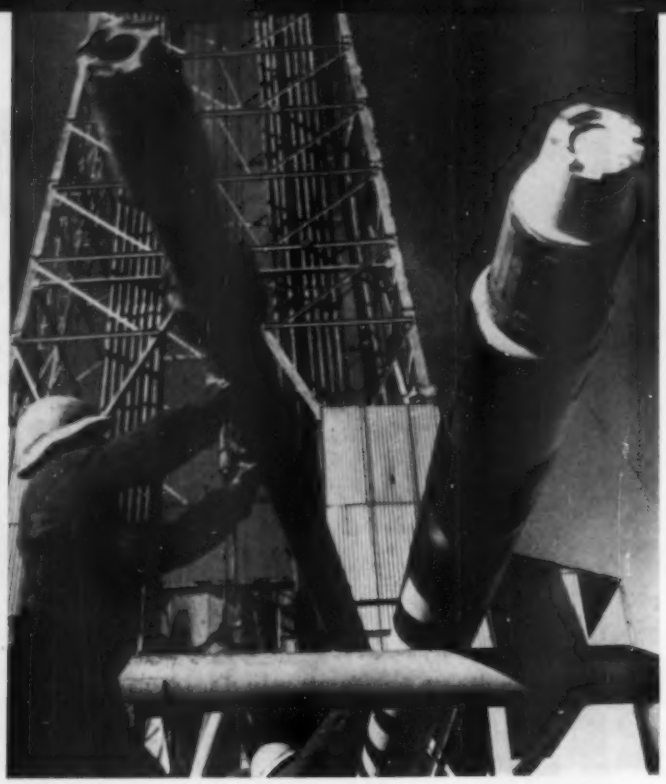
This same technique had been used earlier in two other deep wells in Pecos County. More than 25 packers have been used in these three wells.



PRODUCTION PACKER was set in the world's deepest well at 24,897 ft. as shown at left. Then first tested zone was plugged off with cement and a packer set above the second zone to be tested, as shown at right.



A DRESSER TURBODRILL of the type used in Herscher, Ill., last summer. Use of diamond bits in hard formations has meant success in several tests in U. S.



FRENCH-MADE TURBODRILLS were used in Lacq field, France, with excellent results, compared with conventional rotary operations. Poor tools were responsible for uneconomical rotary drilling.

Turbodrill: A specialized tool —not a cure-all

BY W. B. BLEAKLEY
Production Editor

THE TURBODRILL was the subject of a clinical study in Tulsa recently, as nearly 100 engineers gathered to review experience with the tool.

The meeting was the SPE-AIME Mid-Continent section study group on field operations. The turbodrill panel, moderated by Arthur Lubinski, Pan American Petroleum Corp., was made up of Joseph A. Mitchell, chief development engineer, and Madden T. Works, manager of operations, Turbodrill division, both of Dresser Industries; W. E. Bingman, turbodrill project engineer, Shell Oil Co.; and M. M. Brantly, Brantly Drilling Co.

Mitchell opened the discussion with some general remarks on the basic principles of operation of the turbodrill. He pointed out that: (1) The mud pump is the primary source of power, (2) speed of rotation is directly proportional to the mud flow rate, (3) torque varies as the square of the flow rate, and (4) power varies as the third

That's the conclusion of an industry panel, which agreed that the turbodrill, with diamond bits can be used economically where:

- Rotary rock bits make less than 75 ft. before failure.
- Rotary penetration rate is less than 10 ft. per hour.
- Rig cost is greater than $50 per hour.
- Hole diameter is less than 9 in.
- Formations are medium-hard to hard.
- Trip time is long (deep hole).
- Rig hydraulics are adequate to handle the turbo tool.

...and with rock bits where:

- Penetration rates are low.
- Hole size is large.
- Formations are hard but not abrasive.
- Trip time is short.
- Rig hydraulics are adequate.

power of flow rate. Additional power and torque can be obtained from the same flow rate by adding more stages to the turbine section of the tool. Up to 200 stages have been used on some tests.

Bingman highlighted 10 or 12 experiments conducted by Shell. These were run in areas where conditions varied, so that some analysis could be made of the tool's characteristics. Canada, West Texas, East Texas, New Mexico, and southern Oklahoma were the sites of the tests in straight, crooked, deep, and shallow holes, with different types of rocks being drilled.

Weaknesses in some of the early models were present in the thrust bearing. One bearing lasted only a short time while drilling with crystalline salt in the mud. Abrasive sand was found to have a marked effect on bearing life also. Some trouble was experienced with the lower radial bearing because this bearing is not completely sealed. Some of the mud (25%) escapes at this point rather than going through the bit. If the pressure drop across the bit increases, due to bit plugging, or if the radial bearing becomes worn, more mud goes past the bearing. If the mud is abrasive, a short bearing life results. Modifications have eliminated most of this difficulty encountered on early tests.

Bingman made the following observations on bit performance:

Off-the-shelf rock bits were not designed for turbodrilling operations and should not be expected to give completely satisfactory performance. Footage per bit has been about 50 to 75% of that with the same bit on a conventional rotary rig. Tests have been made with modified bits using larger bearings, fluid passages to bearings, different tooth patterns, hard-faced teeth, etc., with no conclusive results. The opinion was expressed that modified bearing design would do much toward improving rock-bit performance.

Diamond bits have been more successful. Two specific cases were cited in which diamond bits drilled in excess of 400 ft. at penetration rates 10 to 50% higher than the rate with conventional rotary rigs. These tests showed a saving of 20 to 25%.

These diamond bits were not of conventional design. One had extra-large watercourses to reduce pressure drop, and the other had smaller watercourses located between adjacent rows of diamonds. Both bits had deep concave centers, and no wear was indicated at the conclusion of the tests.

Bingman expressed the opinion that diamond-bit drilling should be exploited, as the greatest advantage in turbodrilling lies in this direction.

Lubinski: What was the salvage value of diamond bits used in your tests?

Bingman: On one of the successful tests that were mentioned, the net bit cost was $1,300.

Lubinski: Would you make a guess as to the per cent of total drilling that will be done with the turbodrill in 2 or 3 years.

Bingman: This is strictly a guess, but only about 5% of the total, because of the tool's limitations, such as poor performance in shale.

Lubinski: What about shale streaks in hard formations?

Bingman: Turbodrill is better than conventional rotary, even though the instantaneous rate in shale is low.

The results of drilling activity in France with the turbodrill were reported by B r a n t l y. Reports from France and Russia were strongly in favor of the turbodrill, and Brantly visited the French operations in Lacq field to obtain first-hand knowledge. He found these conditions:

- Operators could not buy U. S. tools because of dollar shortage.
- Delivery of French-made tools, especially drill pipe, required 12 to 24 months.
- Drill pipe in use was old and ready for the scrap pile.
- About 50% of the drilling time was spent fishing for twisted-off drill pipe.
- The turbodrill saved much time and money compared to conventional operations with defective tools.

The result was wild acclaim for the turbodrill. Because there is no torque transmitted by the pipe in turbodrilling, the pipe condition is not too important, and low-grade pipe will stand up. By eliminating the fishing jobs alone, the turbodrill cut time and costs.

Rock-bit life on the French turbodrill was no better than with rotary rigs. Bits were **not** worn out, but rather replaced because of bearing failure in 90% of the cases.

The French first drilled with a 10-in. turbine in a 12¼-in. hole, using an 80-stage Russian turbine, changing later to a 200-stage turbine. Results were satisfactory, so they tried a 7-in. turbine in an 8¾-in. hole. Results here were unsatisfactory due to a very short rock-bit life. Diamond bits were tried with good results. The use of diamond bits in small holes is now routine.

One of the big problems in France was the requirement that the holes be kept close to vertical. This increased the drilling costs, more so on turbodrilled holes than on wells drilled with conventional tools. To straighten crooked holes, a sub was machined to be placed above the turbodrill. The pin end of the sub was made so that it was 1° to 2° off of the longitudinal axis. The tool was then lowered in the hole and oriented in the proper direction, and drilling resumed.

Conclusions of Brantly's tour: The turbodrill is an excellent tool, but it is specialized, not a cure-all.

Mitchell made these comments in summary:

1. Money is saved when the bit is on the bottom, and new developments in bit design and construction may lengthen the time that each bit can be used.

2. More field tests must be made, with data being carefully taken, using the turbodrill. Modifications made as a result of these field tests should be checked **in the same area** in order to accurately evaluate the changes.

Question-Answer Session

The meeting was then opened to questions from the floor, and these were answered by the collective panel.

Q. How long will it be before an operator can be advised definitely to use or not to use the turbodrill on the strength of good geologic information in a particular area?

A. This may depend on the future development of rock bits. If the formations are hard, and can be cut with diamond bits, the turbodrill could be recommended now.

Q. What can be done in case of lost circulation?

A. A limited amount of lost-circulation material may be used. In general, the turbodrill is not a good tool in lost-circulation zones.

Q. Can cores be taken with the turbodrill?

A. Yes. With some models a 10-ft. wire-line core barrel can be used.

Q. Early models had natural-rubber parts that prevented the use of oil-base or oil-containing mud. Has this difficulty been overcome?

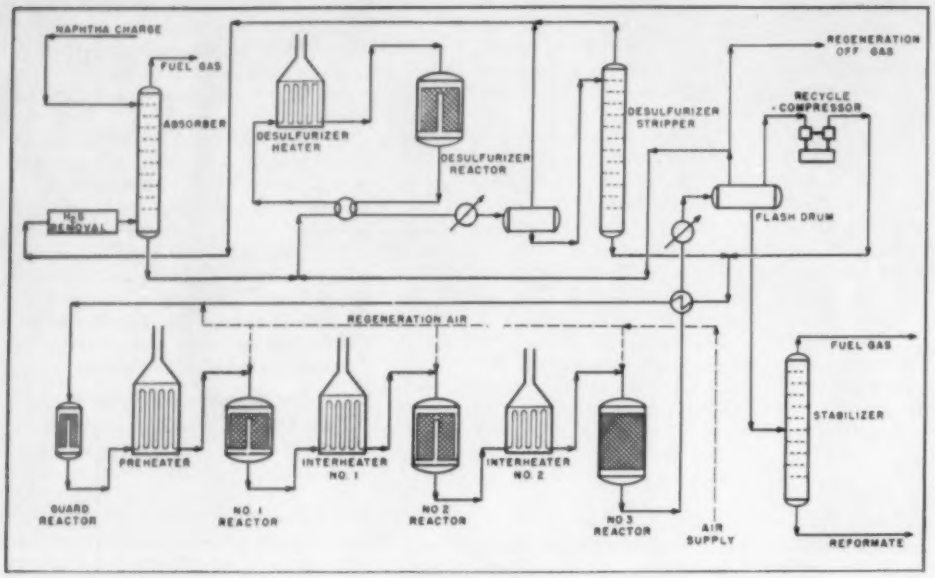
A. Yes.

Separator-Capacity Charts Mislabeled

In the article, *New Charts Determine Separator Capacity*, January 5, 1959, page 97, two of the charts were inadvertently mislabeled. The chart on page 98 is titled *Liquid Capacity of a Horizontal Separator*. And the abscissa for the graph also refers to *horizontal* separators. Actually, this nomograph is to be used with *vertical* separators, as is indicated on the scale label at left.

The chart on page 100 refers in title and abscissa for graph to capacities of *vertical* separators. This nomograph is to be used with *horizontal* separators, as indicated on the scale label at left.

Fig. 1.



Using this process system at Sinclair's Houston refinery . . .

Cat reforming with RD-150

has processed more than 20,000,000 bbl. of naphtha with the initial catalyst charge—a catalyst life of 113 bbl. per lb.

BY W. H. DECKER AND C. RYLANDER
Sinclair Refining Co.

AFTER INITIAL STARTUP in early 1956, the Sinclair cat-reforming unit ran continuously for 26 months before the first regeneration. More than 17,000,000 bbl. of naphtha was processed at an over-all stream efficiency of about 95%. Since the regeneration, stream efficiency has been about 97%, with no significant decline in catalyst performance.

The regeneration was made during the course of a major turnaround, so that the catalyst could be inspected and tested. Cause of the turnaround was increased pressure drop across the reactor. This was due to an accumulation of fine-scale particles carried over from the desulfurizer stripper tower.

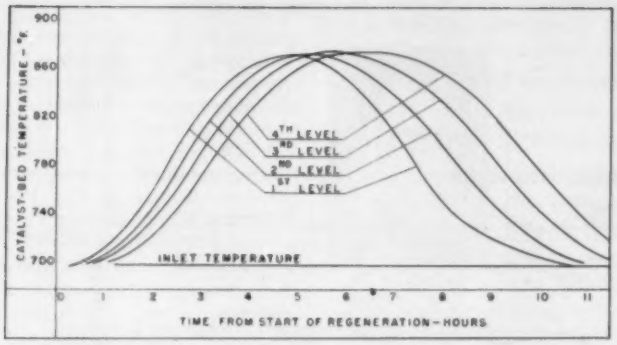
Catalyst development . . . Recognizing several years ago that existing reforming processes would be unable to meet the predicted octane levels of the motor-gasoline pool the Sinclair Research Laboratories, Inc., and Engelhard Industries, Inc., jointly developed a new platinum catalyst to be used as the basis for an improved reforming process. This process was first announced at the May 1953 meeting of the Division of Refining of the API.[1,2]

Concurrently with this announcement, design and construction of a 16,000-bbl. per day unit using new RD-150 catalyst was begun at the Sinclair's Marcus Hook refinery.[3] This was the first phase of a program for the installation of catalytic reforming facilities and since that time a total of 70,000 bbl. per day of reforming capacity using this catalyst has been placed in operation by Sinclair.

The wide acceptance of this catalyst by others in the industry is seen from the fact that capacity in excess of 400,000 bbl. per day is now in operation or under design or construction throughout the world.

Catalyst characteristics . . . The RD-150 reforming catalyst has these characteristics:

- High paraffin dehydrocyclization activity.
- Low hydrocracking activity.
- Excellent resistance to permanent poisoning effect of sulfur, metals, or water in the virgin naphthas.
- Promoters not required for the maintenance of catalyst activity.
- Maintenance of essentially constant yield structure over the life of the catalyst.
- Ability to be easily regenerated, in situ, so that high activities may be maintained during the life of the catalyst.



COMBUSTION WAVE that passes through the bed is shown in a plot of typical reactor-bed temperature profiles during regeneration, versus the time from the start of air admission. Fig. 3.

seen that the catalyst regeneration has had no adverse effect on yield structure when suitable adjustments are made for the slightly lower average octane (96.7 RON +3 cc. TEL) and correspondingly higher yield (88.4 vol. %) for the second cycle.

The constancy of the liquid yields would be even more apparent if minor adjustments were made to reflect the variations in both feed-stock quality and octane level. This factor of constant yield during the life of the catalyst is of considerable importance to the refiner both from the standpoint of future production planning and savings in liquid product values, when compared to those cases wherein a reduction in reformate yield occurs with increasing catalyst age.

Stability . . . The stability of this catalyst with respect to activity is also illustrated in Fig. 2. Here it will be seen that the initial activity, as measured by the average reactor inlet temperature, was 900° F.; excluding the first 2 weeks of operation at low throughputs and low octanes. During the next 26 months of the first cycle the temperature requirement had increased only about 20° to 920° F. at the time of the shutdown. After the regeneration the temperature requirement was again 900° F., which is equivalent to the virgin activity.

For the second cycle the rate of decrease in activity appears to be essentially identical to that of the first cycle. During most of the operations shown here the reactor-inlet temperatures were equal, however, during certain periods of operations different reactor-inlet temperature patterns were used.

It is this condition that is partially responsible for the apparent variations in the throughput-octane level-average temperature relationship. Another contributing factor is that of the variations in feed-stock quality that would normally be associated with changes in throughput.

From these data it will be evident that the first cycle of operations could have been extended past the 26-month period from the standpoint of both catalyst activity and selectivity. However, because of mechanical factors usually associated with such long operating cycles it was necessary to shut down the unit for a major turnaround and inspection. During this shutdown the catalyst beds were opened for inspection and catalyst sampling.

Subsequent laboratory study and evaluation of these samples indicated that no significant changes in the physical characteristics of the catalyst had occurred that would contribute to a loss in either activity or selectivity. These experimental tests also confirmed that the regeneration had restored the catalyst to essentially virgin performance levels.

Catalyst Regeneration

Regeneration of the catalyst becomes desirable when the accumulation of the carbonaceous material has reduced the activity of the catalyst below acceptable limits. Removal of these deposits by combustion in a dilute air stream will substantially restore the activity to its initial value. The processing period between regenerations will be a function of the quality of charge stocks, the operating severity, and the operating conditions such as pressure and space velocity.

The actual regeneration of the catalyst is accomplished by stoppage of the naphtha flow, purging of the system for removal of residual hydrocarbons, and then pressuring with nitrogen or inert gas to 50-100 psig. Recycle inert-gas circulation is then established through the normal system, the heaters are fired to the 650°-700° F. range and air is admitted to each reactor inlet as shown on the accompanying Fig. 1.

The combustion wave that passes through the bed is shown in Fig. 3 which is a plot of typical reactor-bed temperature profiles during regeneration versus the time from the start of air admission. After completion of the passage of the burning wave through the reactors, the inert gas is purged from the unit and processing operations are resumed.

The regeneration system involves only conventional equipment inasmuch as the catalyst is insensitive to the concentrations of water and carbon dioxide produced during the regeneration, and additionally, a wide range (50-400 psig.) of operating pressures can be used as required by associated plant conditions and equipment limitations. The recycle inert gas is cooled in the normal process coolers and the excess gas is released from the system to maintain pressure; this prevents any excessive increase in the water concentration in the system.

The equipment required consists of only an air compressor or an air-supply system and the necessary air-supply connections to the reactor inlets. The regeneration operation requires from 24-72 hours depending upon equipment used, the combustion air available, and the amount of coke present.

Three days required . . . For this regeneration a total elapsed burning time of approximately 72 hours was required. The coke was distributed through the three main reactors as follows:

Reactor—	Lb. of coke per lb. of catalyst
No. 1 reactor	0.098
No. 2 reactor	0.071
No. 3 reactor	0.118

These results were calculated from oxygen-disappearance data.

Summary

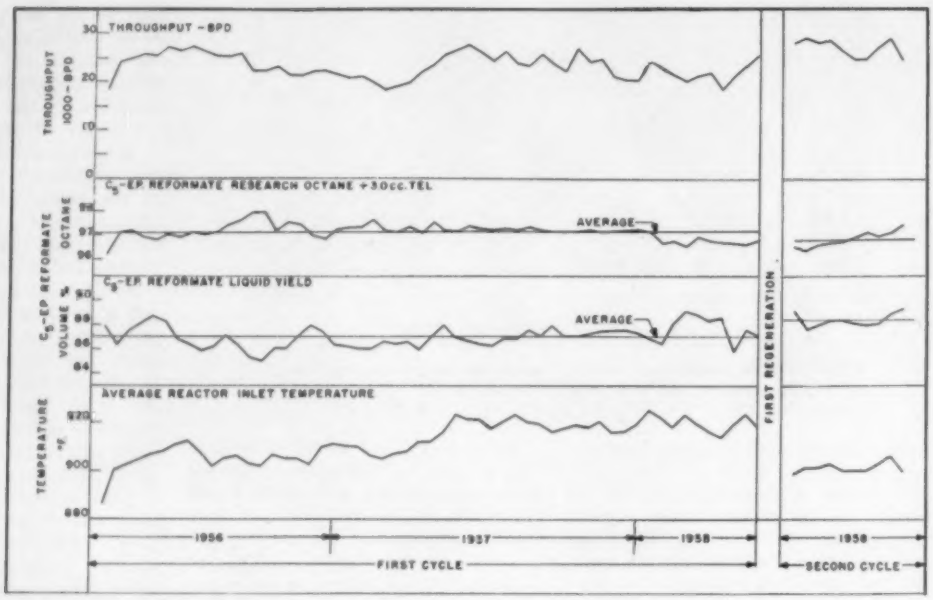
The 2½ years' operation of this unit has furnished an excellent demonstration of the performance of the RD-150 catalyst. The stability of the catalyst with respect to selectivity, the resistance to permanent poisons, the elimination of the need for promoter addition to maintain activity and the ease and efficiency of regeneration allows this catalyst to be maintained at or near virgin activity throughout its life.

The authors wish to acknowledge the permission of Sinclair Refining Co., Sinclair Research Laboratories, Inc., and Engelhard Industries for the publication of this information.

References

1. The Oil and Gas Journal, 51, No. 57, p. 131, April 27, 1953.
2. Pet. Proc., "What's Happening," 8, No. 5, p. 623, May 1953.
3. The Oil and Gas Journal, 54, No. 9, p. 80, July 24, 1955.
4. Pet. Proc., Teter, J. W., Borgerson, B. T., and Beckberger, L. B., Vol. 8, p. 1519, 1953.

OPERATING log of Houston cat reforming unit. Fig. 2.



Thus far a cumulative catalyst life of approximately 113 bbl. per lb. has been attained and at the current 20 bbl. per lb. second-cycle life there has been no significant decline in catalyst performance.

The stream efficiency for this cycle has been in the order of 97% with a consequent over-all stream efficiency of 95%. Again as in the case of the first cycle the interruptions in service were the result of minor mechanical difficulties.

Reformate inspections . . . Inspections of the typical reformate are presented in Table 1. These inspections represent partially debutanized stabilizer bottoms product and as a consequence contain between 1 and 3 vol. % of butanes. For this operation the stabilizer is operated primarily to obtain a butane cut so that the isobutane can be recovered in other equipment, and as a result there is n-butane rejection with the reformate.

After allowance is made for this butane retention it is apparent that the low R.v.p. of the pentane-plus portion of the reformate makes this a high-quality gasoline-blending stock because of the high butane-addition factor. For example, when pressuring with normal butane, the 10-psi. R.v.p. gasoline yield would be 99.0 vol. %.

It should also be noted that the reformate produced has a low end point, characteristic of the RD-150 catalyst, and as a consequence it is not necessary to rerun the stock for removal of any heavy polymer fraction. Typical yields are presented in Table 2.

Operating pressure . . . It is of interest here to review the background for the selection of the operating pressure of this unit. Because of the versatility of the RD-150 catalyst it is possible to select operating conditions over wide ranges: 200-750 psig. pressure, 850°-1,000° F. reactor inlet temperatures, 1 to 6 weight-hourly space velocity, based on fresh feed, and 3 to 12 molal gas-recycle ratio.

For this unit a nominal 350-psig. operating pressure was chosen because of the superior hydrogen and gasoline yields at this pressure in contrast to say 500-psig. operation. While lower pressures tend to shorten the catalyst life, other experience had indicated that the catalyst life would be sufficiently long at 350 psig. so that it would more than justify a shorter cycle life.

This factor of improved yields can be seen from the fact that for a typical Mid-Continent naphtha processed for 90 research octane number (RON) reformate at 500 psig. the liquid yield would be 84.9 vol. %, while at 350 psig. the yield would increase to 86.0 vol. %. At 95 RON (clear) the yields would be 80.4 and 82.4 vol. % respectively for 500 and 350-psig. operation. Lighter stocks and those having a higher paraffin content would give a considerably greater change in yield for the same pressure difference.

Operating experience on this unit has more than justified this original selection inasmuch as the cycle life has not been a limiting condition of operation.

TABLE 1—TYPICAL INSPECTION OF NAPHTHA AND REFORMATE

	Naphtha	Reformate
ASTM distillation, °F.:		
Gravity, °API	55.6	48.2
I.b.p.	185	145
10%	237	208
30%	255	245
50%	267	262
70%	283	279
90%	324	325
E.p.	380	391
R.v.p., lb.	...	3.1
Type analysis:		
Paraffins, vol. %	43.1	43.2
Naphthenes, vol. %	46.0	5.7
Aromatics, vol. %	10.9	51.1
Octanes:		
Research method:		
Clear	47.8	87.4
+3 cc. TEL	71.7	97.0

TABLE 2—TYPICAL REFORMING-UNIT YIELDS

H_2, wt. %	1.7
C_1, wt. %	1.2
C_2, wt. %	1.5
C_3, wt. %	2.2
iC_4, vol. %	1.3
nC_4, vol. %	2.4
C_4-e.p., vol. %	90.7
C_5-e.p., vol. %	87.0
10-lb. R.v.p. gasoline, vol. %	99.0

Catalyst Performance

Because of the importance of the factor of catalyst performance in evaluating reforming unit operations it is of interest to review in detail the performance history of the RD-150 catalyst in this unit. The data presented in the operating log (Fig. 2) has been taken directly from the weekly operating reports of this unit.

During the first cycle the C_5-e.p. research octane +3 cc. TEL averaged 97.1 while the C_5-e.p. reformate yield was 87.0 vol. %. It is clearly evident that there has been no significant change in the yield structure of the aged catalyst when compared with the virgin catalyst. Also it will be

With these catalyst characteristics it is possible to adjust the design conditions to get the best yield-octane relationship for any type of naphtha.[4]

The regenerability of the catalyst makes it possible to both extend the life of the catalyst and to maintain high activities over this life. This feature also provides insurance against accidental loss in activity resulting from operational difficulties. The short regeneration-time requirement and the satisfactory long cycle life combine to give high operating-stream efficiencies.

Cat reforming is the specialty of the two authors, W. H. Decker and C. Rylander. Decker is technical assistant to the director of the process division, Sinclair Research Laboratories, Inc., and since 1952 has done most of his work in catalytic reforming. Rylander is operating superintendent of Sinclair's Houston refinery. He first joined the technical division, and then transferred to the operating division, where as division head of light oil, he had direct supervision over the cat reformer operation.

W. H. Decker

C. Rylander

Processing System

The Houston reforming unit is designed for a nominal 24,000-bbl. per day throughput of desulfurized virgin naphtha. The catalyst is distributed through four conventional fixed-bed adiabatic reactors, with interheating between reactors, at a design over-all weight hourly space velocity of 1.50.

System pressure is adjusted to maintain 350 psig. on the flash separator and the recycle ratio is maintained in the range of 7 to 10 moles of total gas per mole of naphtha feed. This is equivalent to a hydrogen recycle ratio of approximately 6 to 8 moles per mole of feed.

Flow scheme . . . The basic process flow of this unit is illustrated in Fig. 1. The straightrun gasoline is first prefractionated (using equipment not shown) to a fraction with an ASTM boiling range of approximately 185°-380° F. This naphtha is then fed as a lean oil to an absorber for recovery of butanes and heavier fractions from the net-unit release gas. From the absorber the naphtha is mixed with hydrogen-rich release gas from the reformer flash drum, exchanged with the desulfurizer reactor effluent and then passed through a fired furnace before entering the desulfurization reactor.

From this reactor the desulfurized naphtha and recycle gas is exchanged against feed and cooled before entering an atmospheric temperature flash drum. The hydrogen sulfide-rich flash gas is released to the plant fuel system or hydrogen - utilization equipment through an H_2S removal system and an absorber while the liquid product flows to a reboil-heated stripping column.

Overhead gas from this column, containing the remainder of the hydrogen sulfide, is mixed with the desulfurizer flash-drum release gas and routed to the gas-recovery system. Desulfurized liquid product flows from the stripper bottoms to the reforming unit. This hydrodesulfurization-process system uses a cobalt-molybdenum catalyst developed by the Sinclair Research Laboratories, in cooperation with the catalyst division of the National Aluminate Corp.

Reactor system . . . The desulfurized naphtha, after mixing with the hydrogen-rich recycle gas, is exchanged against reactor effluent before passing into the heater-reactor system. This preheated naphtha-recycle gas stream flows first to a small guard reactor, containing platinum catalyst, between the feed-effluent exchangers and the No. 1 reactor preheater.

From the guard reactor the stream passes in series through the preheater, No. 1 reactor, No. 1 interheater, No. 2 reactor, No. 2 interheater, and No. 3 reactor. The guard reactor accomplishes a limited amount of dehydrogenation and at the same time serves as a guard against contaminant "breakthrough" from the desulfurizer system, either due to excessive catalyst age or to operational difficulties on this equipment.

The No. 3 reactor effluent, after exchanging with reactor feed, is cooled to atmospheric temperature and passed into a high-pressure flash drum where the product is split into two streams. The liquid product flows to a column for stabilization to the required vapor pressure, with rerunning of the reformate not required since no significant amount of heavy polymer is produced by the catalyst.

The reformate from the stabilizer is further fractionated (using equipment not shown) into light and heavy reformates for selective gasoline blending and petrochemical manufacture. The overhead from the stabilizer is released to the fuel system or to subsequent light-ends recovery facilities. The hydrogen - rich gases from the high-pressure drum are recycled to the inlet naphtha system, while the net gas production is released to the feed pretreatment system.

Unit Operations

The unit was originally placed on stream in March of 1956, processing mixtures of Mid-Continent, South Texas, East Texas, and sweet and sour West Texas naphthas with typical inspections as shown in Table 1. This first cycle was continued for a period of 26 months until May of 1958 when it became necessary to shut down the unit for a major turnaround. During this period a catalyst life of 93.1 bbl. of naphtha feed per pound of catalyst was accumulated at a stream efficiency of approximately 95%.

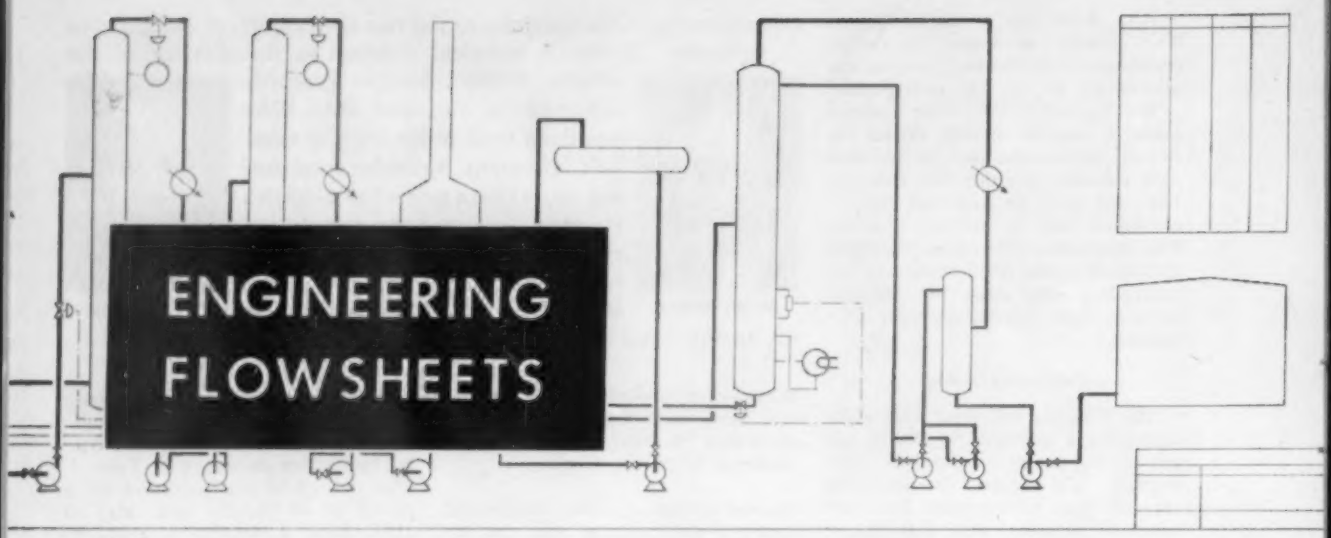
This stream effiicency would have been higher had it not been necessary to bypass the reforming sections for several short periods because of mechanical difficulties on the desulfurization unit. During these periods of bypassing the reforming reactors were maintained at near-operating conditions of temperature and pressure with only the naphtha being diverted from the unit.

It is also of interest to note that during several periods of mechanical difficulty on the desulfurizer equipment the reformer was continued in service with only the high-sulfur-content naphtha bypassing the reforming unit. This latter step was taken in order to minimize scale formation in the system.

First shutdown . . . The first major shutdown was the result of a gradual buildup of pressure drop across the guard reactor. During the subsequent reactor internal inspection it was found that this pressure drop was caused by an accumulation of fine-scale particles that had been carried from the desulfurizer stripper tower. Had it not been for this pressure-drop condition the first cycle would have been continued inasmuch as the catalyst performance with respect to activity and selectivity was still satisfactory.

At the time of the shutdown the reforming catalyst was regenerated so that the reactor beds could be thoroughly inspected.

The second cycle, following the turnaround, was started in May of 1958 and is currently in progress.



ENGINEERING FLOWSHEETS

BY D. J. ORIOLO
Catalytic Construction Co.
Philadelphia, Pa.

FIRST MAJOR STEP in the design of processing facilities is preparation of the process flowsheet in order to illustrate the process involved and to reflect the fundamental process design. Scope of the process flowsheet and its value to the development of a commercial plant design have been discussed in an earlier article.[1]

Before work can proceed, however, on the detailed design of the plant, it is necessary to develop the engineering flowsheet. The engineering flowsheet is the starting point and basis for all the activities entering into the definitive engineering and design of processing facilities.

From the design criteria specified on the engineering flowsheet, the specific requirements for all of the facilities can be translated into the many working drawings and specifications covering the complete plant assembly, including piping, instrument, electrical, concrete, structural, and architectural design.

Scope of Flowsheet

The engineering flowsheet is, in effect, a detailed expansion of the process flowsheet. The engineering flowsheet shows all of the equipment, all of the piping, and all of the controls which constitute the complete plant assembly. Comfort heating and ventilating equipment are not shown unless they are integral to the process. Structural and architectural facilities and electric-power stations and distribution systems are never shown on engineering flowsheets.

In many instances it is advantageous to show on the engineering flowsheet, complete piping, including headers and tie-ins, for all of the utilities (air, water, steam, fuel oil, fuel gas). However, when the process is extensive and complex, it may be found desirable to show all of the utility headers on a separate drawing, commonly termed the utility diagram.

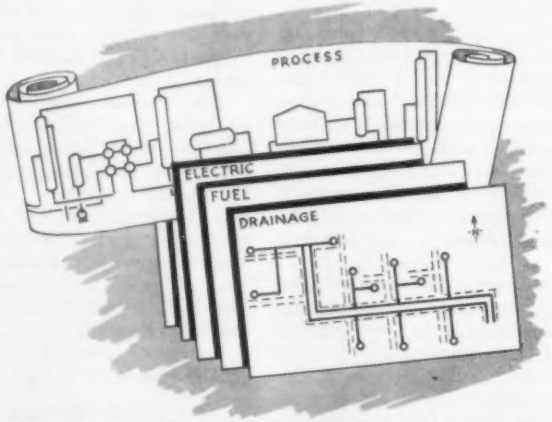
Before proceeding with the detailed development of the engineering flowsheet, it is important to reach general acceptance on the process flowsheet, on all of the utility requirements, on the basic plant layout, and, if possible, on general equipment arrangements.

Before the engineering flowsheet can be completed, however, it is essential that the kind and size of all equipment must have been established. The selection and procurement of equipment must be started in the early stages of the over-all plant design.

How Many to Use

The number of engineering flowsheets required may vary considerably, depending on the size and type of processing facilities involved. For example, a new, grassroots commercial plant, of large size and complexity and including new service facilities, might require the following number of engineering flowsheets as a minimum requirement:

- One flowsheet for the tank farm and general storage and handling of feed stocks.
- One flowsheet for each of the major processing steps or areas.
- One flowsheet for storage and handling of products.
- Individual flowsheets for each of various service units, such as steam-generation station; central refrigeration plant; central compressed-air plant; central heating-oil system; and central water-treatment system, including any cooling towers, water wells, spray ponds, and the like.



"The size of flowsheet to use will vary depending on the process involved . . ."

● At least one utility diagram is necessary.

Size and Arrangement

The size of flowsheet to use will vary depending on the process involved, its complexity, and on the preferences of the particular organization. Usually the flowsheet will have a width of 24 to 30 in. and a length of 36 in. or greater.

The strip flowsheet (length varying above 3 ft. and often above 10 ft.) has advantages in that it permits more flexibility in arrangement and gives an encompassing picture of the total over-all design requirements. When reduced photographically to a width of 11 in., the strip flowsheet is manageable and can be neatly folded for inclusion in various types of design reports and operating manuals.

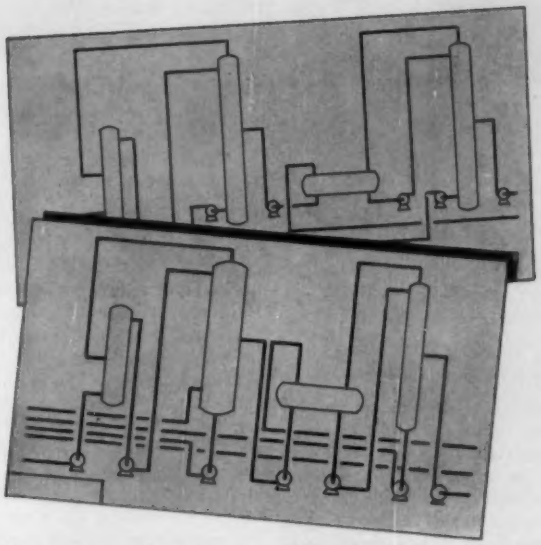
The smaller size of drawings, such as 24 in. wide and 36 in. long, will generally require a number of sheets, each with match lines and suitable crossreferences, to illustrate a particular process. The main advantages of this smaller-size drawing is that it is more manageable on the design board and in the field during plant erection; and will permit more flexibility and efficiency in using design and drafting manpower in the development of the engineering flowsheet and all the piping drawings.

Primary reference . . . The engineering flowsheet is the primary reference used by engineers and designers in developing design criteria into specific drawings and specifications. Accordingly, it is essential that the flowsheet be arranged to permit an accurate, readily visualized, representation of all the design requirements.

Do not crowd the drawing, and leave sufficient space for the inclusion of description data; legends on pipe, valve and instrument symbols; designations; general notes on reference drawings; and for probable later information. While representation of equipment and flows is schematic and not to scale, it is important to show equipment in proportion to relative size and to depict small items, such as valves and instruments, large enough to be read.

It is convenient to use the principle of base lines in laying out the flowsheet. For example, major process equipment, such as reactors, process vessels, fractionators, heat exchangers, etc., may be located on or above an upper base line, with due regard to relative equipment location and to actual material flow.

On the lower base line would be located such items as pumps and compressors and all major piping runs would be shown between the upper and lower base lines. As an alternate method, all the equipment may be located in relative position above a single base line and all main piping runs are shown below this base line.



"It is convenient to use the principle of base lines in laying out the flowsheet."

The forward flow of process streams is almost always from left to right. Process lines show to advantage when made heavier than utility lines and equipment outlines. All lines entering or leaving a flowsheet must be properly tagged to indicate the source and eventual disposition, including flowsheet reference number.

Equipment

All items of process, mechanical, and auxiliary equipment, including spare and standby units and parallel trains of equipment, should be shown on the engineering flowsheet.

Symbols used to represent the equipment should be simple, functional, yet look like the actual equipment. For example, pumps should be differentiated as to whether they are vertical or horizontal, positive-displacement, sump, deep-well, or centrifugal type. In many instances it is important to specify the static suction elevation on the flowsheet. For heat exchangers, differentiate as to type (shell-and-tube, double-tube, coils), number of shells, and relative locations and directions of material flows in tubes and shells.

Motors and other types of drives should be shown on all moving machines, including mechanical agitators, pumps, compressors, conveyors, feeders, filters, centrifuges, crushers, grinders, and the like.

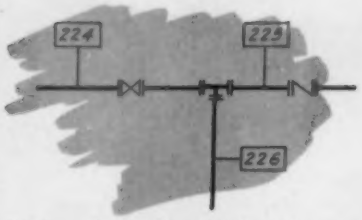
The actual number and size of nozzles, inlet, and outlets must be shown with due regard to relative location on all vessels and all other equipment and machinery, where applicable. Flanges, heads, jackets, and internals should be represented simply on all vessels, including fractionators. Distances to base lines should be specified when critical to the process.

Data listing . . . Adjacent to each piece of equipment should be listed pertinent data such as descriptive title of the equipment, equipment item number, capacity, size, duty, or some significant operating requirements in the case of special equipment. Do not crowd the flowsheet with unnecessary equipment details since such information is adequately covered in the equipment specification.

For pumps, list the design capacity in gallons per minute, the total dynamic discharge head (TDH), and the required horsepower for the motor drive. For compressors, list the intake capacity, the temperatures and pressures at the intake and discharge of each stage, and the required horsepower if a motor drive is employed.

List design duties, B.t.u. per hour, for all furnaces, heaters, coolers, condensers, and heat interchangers. On process vessels, list design temperatures and pressures and give capacity or size information. On storage tanks, specify the liquid full capacity. For all other equipment, specify relevant data necessary to define equipment function.

Systems for designation of equipment item numbers may vary considerably, depending primarily on the accounting codes in effect for a particular organization. A suggested sys-



"All valves should be shown in piping lines . . ."

tem to employ is discussed in an earlier article.[1]

Piping

The engineering flowsheet should show utility piping and all process piping including vents, drains, traps, sampling taps, relief lines, all in-line instruments, and all startup lines and bypass lines necessary to operate the plant. When applicable, show locations for corrosion test coupons.

When utility headers are shown on a separate utility diagram, the engineering flowsheet should show the tie-in connections, including all valving and controls, for each particular utility to the specific piece of process equipment involved.

The utility headers on the utility diagram should be shown schematically, with due regard for the arrangement of process equipment serviced. Such equipment is simply outlined in block form to include references to drawing and equipment designations and to operating conditions, such as utility usage, temperatures, and pressures.

Valves . . . All valves should be shown in piping lines, with recognition by code symbols given to the size of valve; the type of valve, such as, gate, globe, check, plug, slide, butterfly; and whether the valve is flanged, screwed, or welded.

Pipe fittings are not shown in piping lines, except that reducers or expanders are usually indicated by symbol to emphasize a change in the size of pipe. Blind flanges in headers and companion flanges at vessels and equipment are generally shown on the flowsheet.

A line numbering system, including line designation tables, is used to completely identify a pipeline and the material flowing through the pipe.

Pipelines are numbered on the flowsheet by related code numbers which include prefix letters to designate the flowing medium; a number to identify a section of pipeline in a particular sequence of flow; the size of the line in inches; and the number covering the material specification for the pipeline and all the fittings and valves contained therein. An example of a suggested line numbering system:

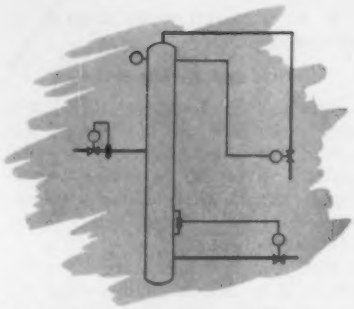
HF-1-2"-5, where
- HF—anhydrous hydrofluoric acid
- 1 —line sequence number
- 2" —line size
- 5 —number of applicable pipe specification

Line numbers . . . In conjunction with line numbers on the flowsheet, it is customary to refer to pipeline designation tables for additional data on fluid properties and operating conditions and for additional remarks as to whether the particular pipeline is insulated or not. Using the line sequence number as a reference value, the tables list design flow rates; temperatures; pressures; velocities of flow; and properties such as specific gravity, viscosity, and concentration of suspended solids. The lines are sized for maximum expected flows; however, where slurries are involved, it is important to also consider the minimum flows and size the lines above the minimum velocity at which solids would settle out.

The pipeline tables also include the thickness of insulation and the applicable insulation specification for any particular section of pipeline. Pipe to be shop-fabricated may also be identified on the pipeline designation tables.

Instrumentation

The engineering flowsheet shows the complete instrumentation, including all hookups, necessary to operate the plant. All indicating, controlling, and recording instruments are shown, indicating the primary elements and the type of control employed (pneumatic, hydraulic, electronic, mechanical, or electric).



"All of the instruments are identified by symbols and a letter code nomenclature . . ."

All of the instruments are identified by symbols and by a letter code nomenclature similar to the system recommended by the Instrument Society of America, as discussed in a previous article.[1] The instrument item number is shown along with and included in the designation symbol.

Sizes are shown for all in-line instruments, such as control valves and relief valves, adjacent to these items. Relief set pressures are also indicated on the flowsheet. All transmission lines are shown with air lines being differentiated from pneumatic and other types of controls. Capillary tubing is differentiated from process lines.

Reference

1. Oriolo, D. J., "What You Ought to Know About Process Flowsheets," The Oil and Gas Journal, November 17, 1958.

Nelson Refinery Construction Index

Appears in the engineering section in the first issue each month.
Compiled by W. L. Nelson, petroleum refinery consultant, Tulsa.

The Index was explained October 1, 1956, (page 110) as well as the Indexes of Individual Items of Equipment that appear on the Costimating page in the first issue of the months of January, April, July, and October.

Index (1946 = 100)

	1950	1954	1955	1956	1957	Oct. 1958
Pumps, compressors, etc.	138.2	166.5	172.2	192.0	206.7	213.3
Electrical machinery	134.9	160.0	162.5	175.0	188.9	193.3
Internal-combustion engines	126.0	150.5	153.2	164.0	173.9	178.0
Instruments	127.8	154.6	162.9	182.1	187.4	197.0
Heat exchangers	140.0	171.7	156.8	190.7	203.6	174.2
Misc. equipment average	*126.2	160.7	161.5	180.5	192.1	191.2
Materials component	149.5	174.6	176.1	190.4	201.9	205.8
Labor component	144.0	183.3	189.6	198.2	208.6	224.1
Nelson construction index	146.2	179.8	184.2	195.3	205.9	216.8

*Used in computing the Nelson Index until April 1952. This is slightly different from the average of the Miscellaneous Equipment Items shown above.

AS UNIFORM AS FORGINGS CAN BE

In making up an order of Bethlehem forgings, we go all out to achieve uniformity. Not just the kind that will pass visual inspection . . . but the kind that stands up under close metallurgical and dimensional inspection. The drop forgings you receive from Bethlehem have been carefully checked. That's why you will find them of uniform quality; uniformly *good.*

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BETHLEHEM STEEL

"On the road or off, our Ford tandem gets us there on time!"

says Mr. H. W. Stooksberry
Stooksberry Tank Co.
Lafayette, Louisiana

"We can't afford delays, and our new Ford T-700 provides the round-the-clock dependability we need.

"Our '59 Ford often runs 24 hours a day to meet the demanding schedules of this business. We haul six types of oil well testing equipment for both offshore and onshore work, and there's always a race against time on every job.

"This portable testing equipment is a big load, and one that pulls hard on the highway. At the wellhead, we often hit especially tough going. We stick with Fords for this work because our experience shows they do the best job, and do it fast and economically."

Go Ford-ward for savings with '59 Ford Trucks!

Whatever your job . . . wherever you do it —you'll find Ford trucks are engineered and built to do it better! Whether you need a 4-wheel drive pickup like the one shown below—or a heavy-duty tandem similar to the one used by the Stooksberry Tank Co., you'll be *ahead* with a Ford. And for '59, there are even more reasons to invest in a Ford Heavy or Extra Heavy. You'll discover:

Greater operating economy with new, faster rear axle ratios and wider choice of transmissions.

More efficient parking brake of the internal expanding type has approximately 50% greater stopping and holding ability, requires less than half the operating effort needed for the previously used type.

Increased payloads and longer axle life with new, higher-capacity front and rear axle options.

Factory installed tractor package custom-fitted to Ford trucks equipped with air brakes for more dependable and safer braking.

Yes, the new '59 Fords are here to take you *Ford*-ward for savings, *Ford*-ward for modern style and stamina. See your Ford Dealer today!

New Ford 4-wheel drive trucks available in ½- and ¾-ton pickup, stake and chassis-cab models. Ford-built at Ford's low prices. Available early 1959.

FORD TRUCKS COST LESS

LESS TO RUN . . . LESS TO OWN . . . LAST LONGER, TOO!

Every Ford has SAFETY GLASS in every window

K. D. RIG...

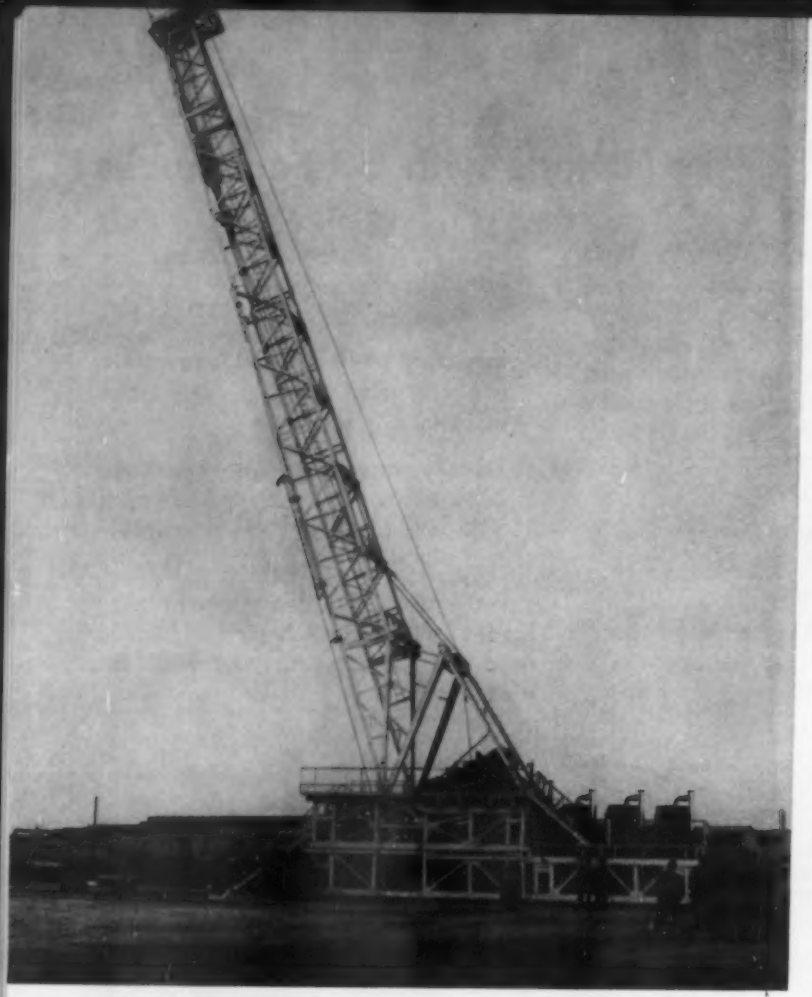
It knocks down into plane-size parts for air shipment

A NEW deep-drilling rig, with equipment grouped into handy packages, can now make a complete move by air into inaccessible spots with little dismantling and confusion.

International Brown Drilling Co. has come up with a carefully packaged 13,000-ft. rig which can be flown to the well site in C-82 Flying Boxcars. Load limit for each plane in the operation is 15,000 lb. The Brown rig is designed so that each package approaches a net of 14,000 lb.

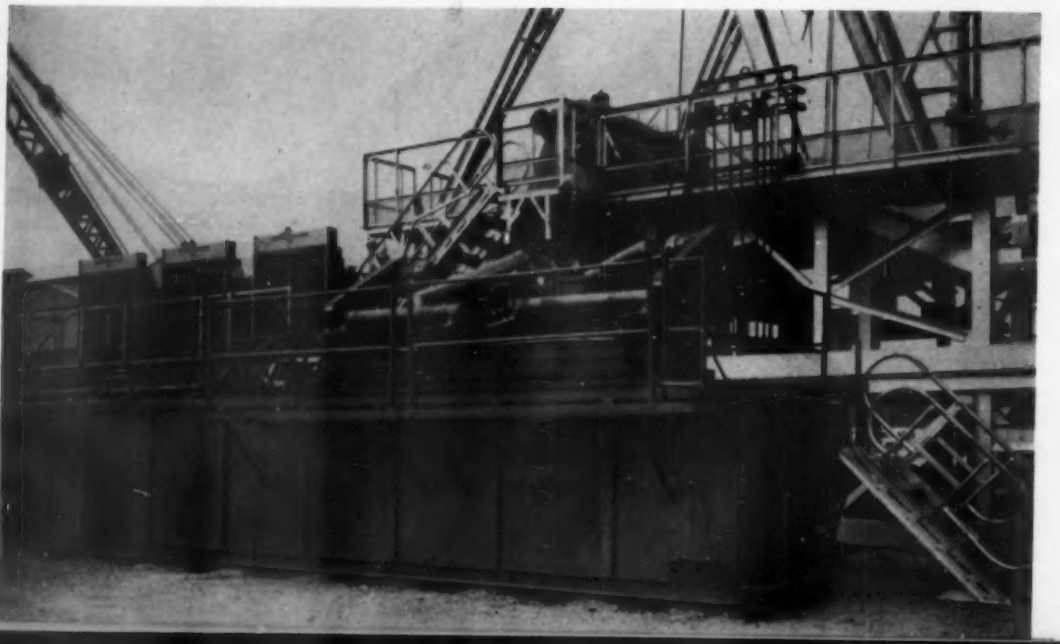
The rig, a National 110, has been contracted to Ohio Oil Co. of Guatemala, a subsidiary of Ohio Oil Co. Brown will drill a 13,000-ft. wildcat for the firm in an almost inaccessible Guatemalan location, which requires that the rig be flown 110 miles inland from Puerto Barrios.

Details of the rig are shown in the accompanying photographs. For more information, please refer to previous Journal article, January 19, 1959 issue, page 130.

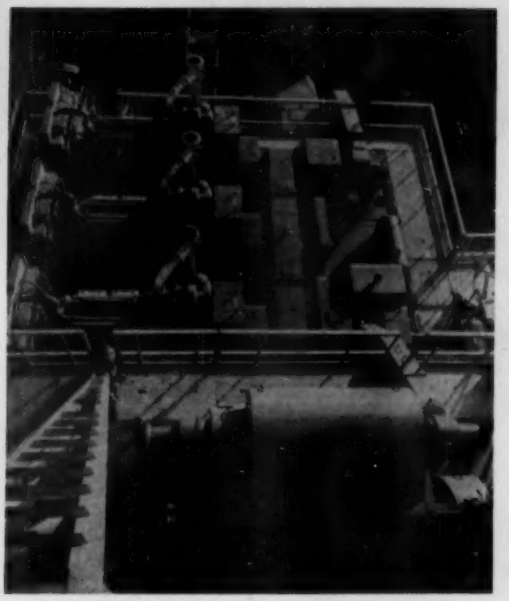


MAST IS DESIGNED so that no heavy trucks are needed to raise it. Tracks at left of substructure allow bottom ends of mast legs to be pulled up to their base; roller on crown allows the entire mast to be pulled along the ground without damage. Draw-works power handles all raising needs.

STEEL MUD TANKS, like the rest of the rig, were sized for length and width, as well as weight. Tanks were designed to fit conveniently into the cargo space of the flying boxcars.



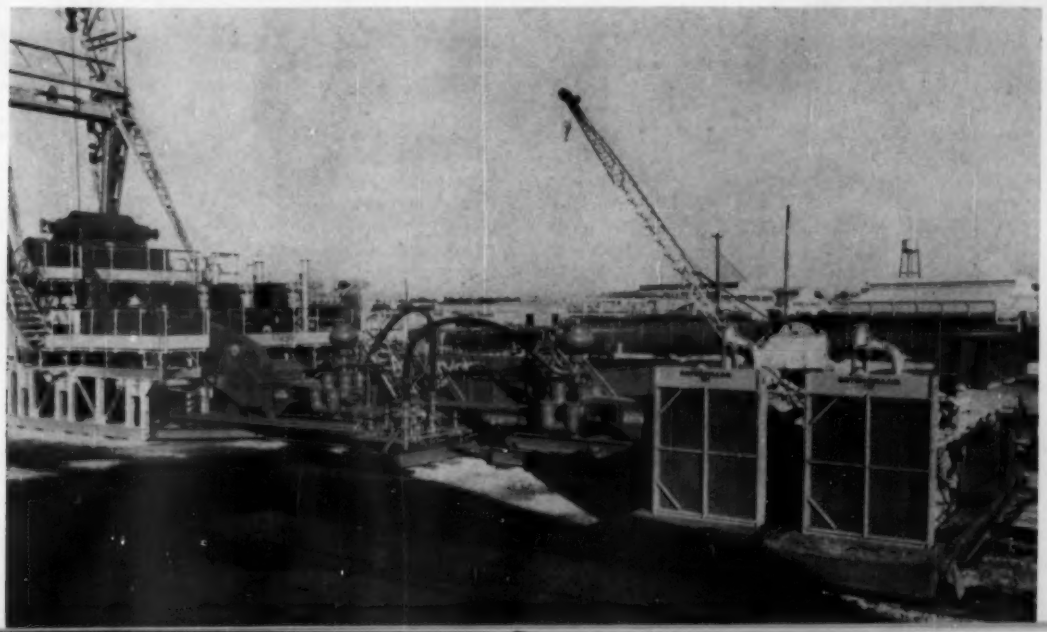
PIN-CONNECTED SECTIONS provide for easy breakdown of mast. Pins are visible at each end of the crossbraces. Substructure is also assembled with pins. Entire mast and base come apart to form packages nearly equal to plane capacity.

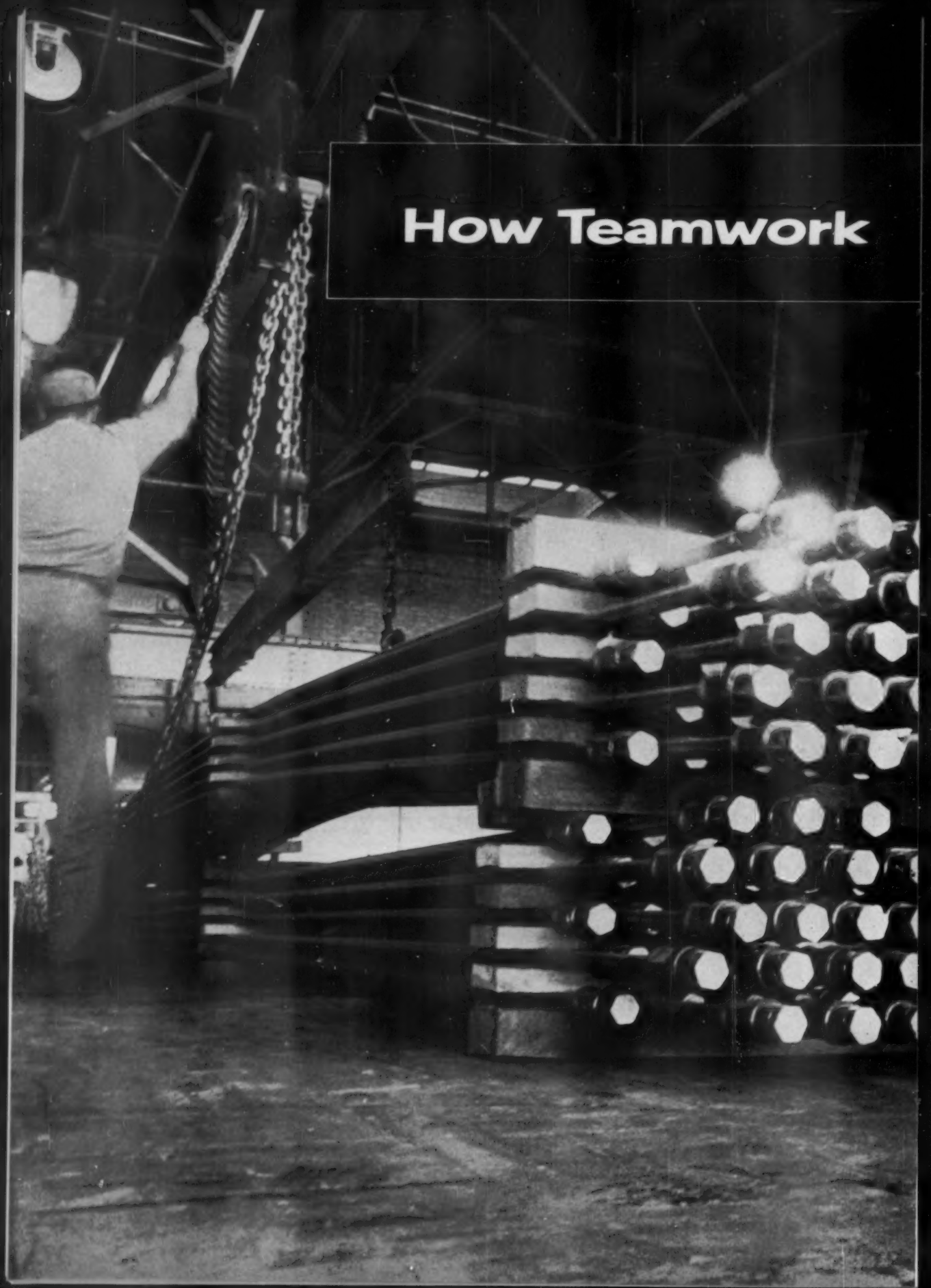


EACH ENGINE-DRIVE FRAME is a near-capacity load. Number one frame, which carries master clutch and auxiliary rotary drive, is heaviest and the only one which requires lightening.

DRAW WORKS of the big rig breaks into several packages. The main drum shaft assembly weighs 15,380 lb., so that a small amount of the assembly has to be removed. Jackshaft and main drive shaft assemblies may be moved intact, since each weighs less than 4,000 lb.

INDEPENDENT PUMP DRIVE, used to drive number two mud pump, is identical to rig engine drive, except for length of skids. Each of the five engines makes one load, as does each engine compound.




How Teamwork

Improves Rod Service

Here's how the J&L-Axelson team can help you get better sucker rod performance.

First, the experience and knowledge of the J&L man enables him to specify the correct size, type and grade of rods for the conditions in your well.

Second, the manufacturing skills developed by Axelson during sixty-six years in the business are your guarantee of uniform high quality. This means all the rods in an Axelson string do their share with no weak links to cause trouble now or later.

This brand of performance has made the J&L-Axelson team the standard for sucker rods throughout the oil fields of the United States and Canada.

Ask your local J&L Supply man for complete information on Axelson Sucker Rods or write us direct, Drawer 2481, Tulsa.

Jones & Laughlin

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If it's sold by J&L....
It's the best available

57

SPECIAL REPORT:

Louisiana onshore drilling costs

. . . with some observations on how to reduce the expense of drilling fluids

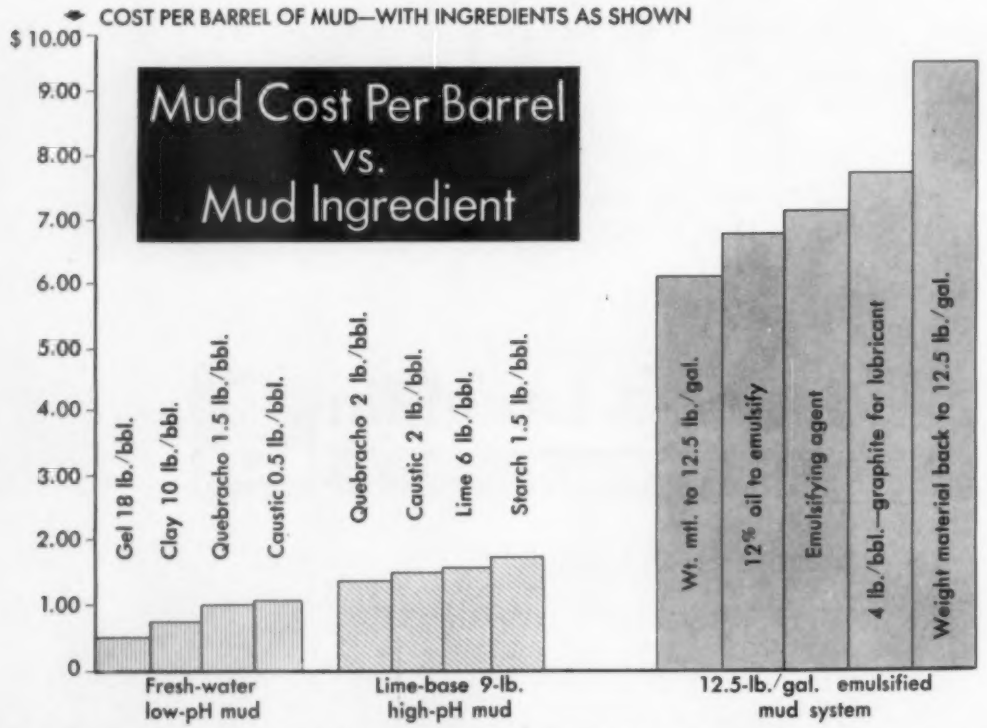
BY L. R. RECORDS
Consulting Engineer, Lafayette, La.

THE GRAPHS on these pages should be a valuable help to management, geologists, engineers, and field drilling men as a guide to average drilling costs for onshore wells in South Louisiana.

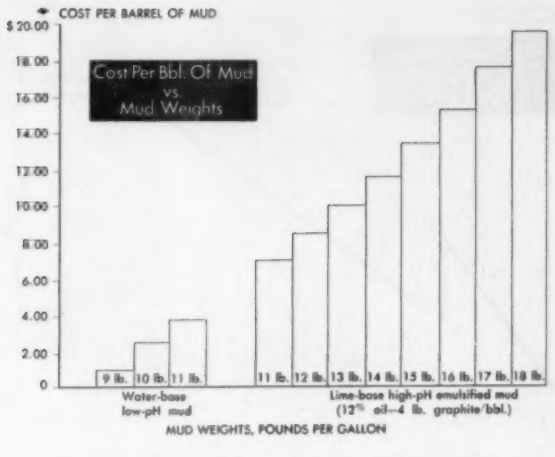
The data on these charts are the average for some 300 wells. Another group of wells might change the averages slightly, but the charts here are good enough for most purposes. The figures do include 1958 costs.

From the charts it is evident that the money spent on mud is a major drilling cost. In addition to designing the mud program and field-testing the mud, the mud engineer who does a really adequate job will also see that mud-conservation equipment such as a centrifuge is used. He will also arrange to bank or sell surplus mud and supervise the use of salvaged or processed mud.

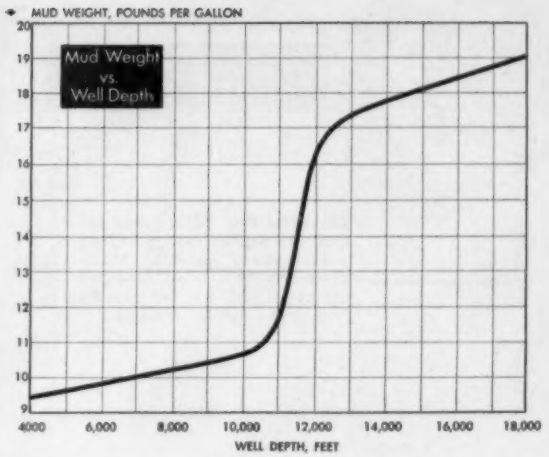
Delivered cost of salvaged mud can be a real savings compared to new mud ingredients. To get maximum benefit from salvaged mud, there has to be a lot of cooperation among operators, contractors, and mud-storage companies. Major expense in most South Louisiana muds is barite; this fact often makes use of centrifuges attractive.



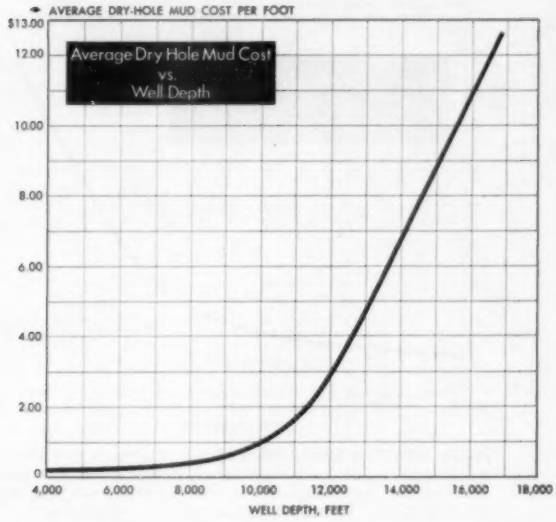
DRILLING FLUIDS, complex chemical mixtures, cost in proportion to the amount of each ingredient. This graph shows incremental costs for 3 common systems.



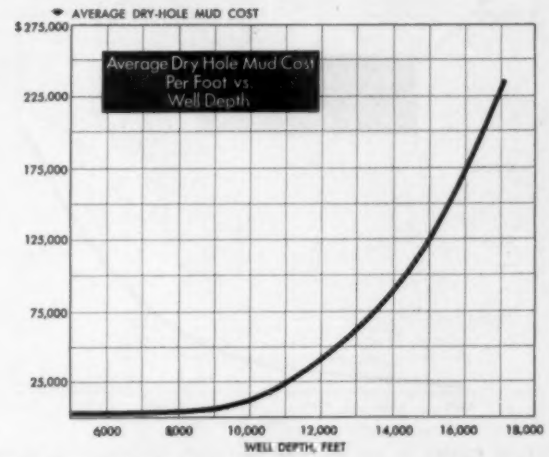
COST OF MUD is almost directly related to weight. On both low-cost water-base muds and higher-priced lime muds, lost-circulation materials or other additives can add greatly to expense.



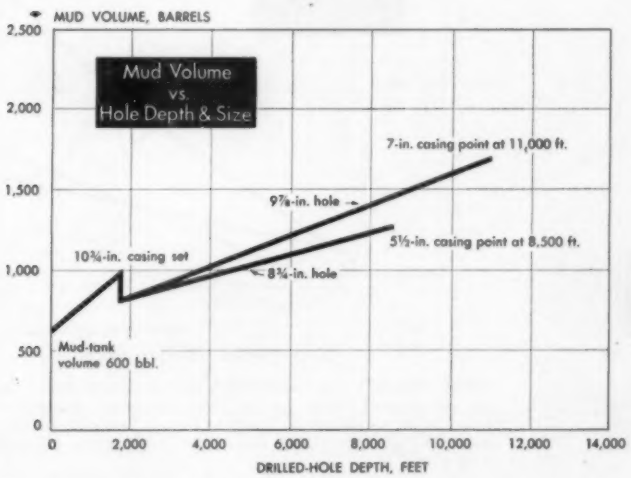
EVERY WELL BELOW 11,000 ft. in South Louisiana may drill abnormally high pressures. This curve is the average of some 200 wells. Actual weights vary widely from one area to another.



TOTAL MUD COSTS VARY with the area and with the amount of testing and other work done. This curve represents about the average for South Louisiana.

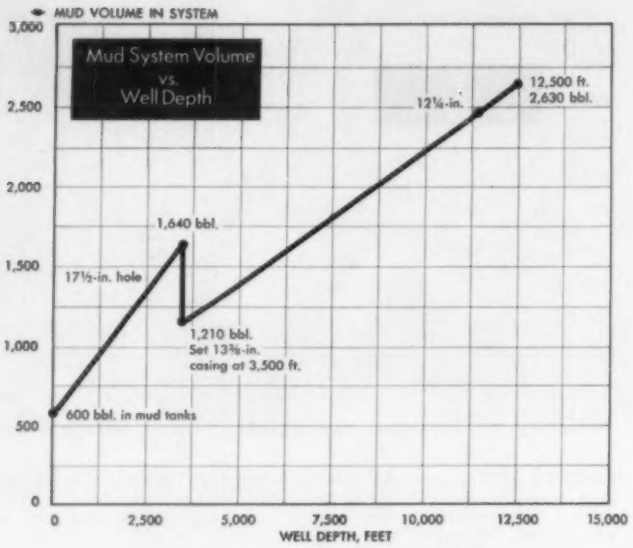


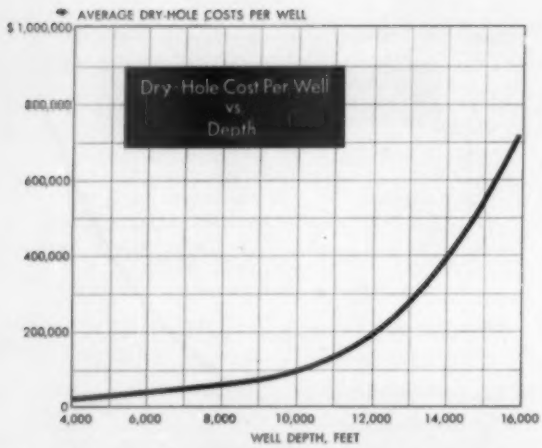
WHILE MUD COST per foot drilled is not a term often used, it can be a help. The 25-cent per foot figure for a 4,000-ft. well and the $12.65 per foot for a 17,000-ft. well show the spread possible.



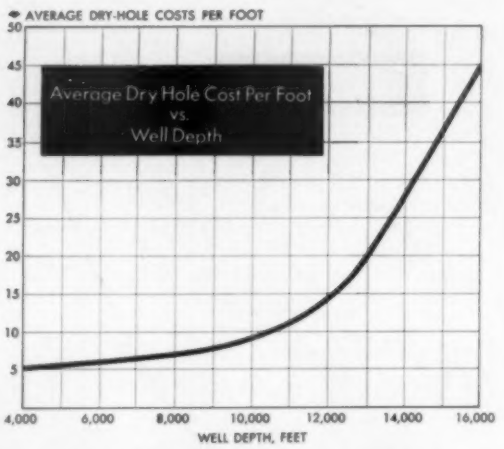
ACTUAL VOLUME of mud in use determines total mud cost. At shallower depths, most of mud volume is in the tanks. Deeper, the hole volume is greater. This graph shows volumes for shallower wells.

DRILLING BIG HOLE sizes for deeper wells means large mud system volume. Maximum in this case reaches almost 3,000 bbl. to handle and treat while drilling.



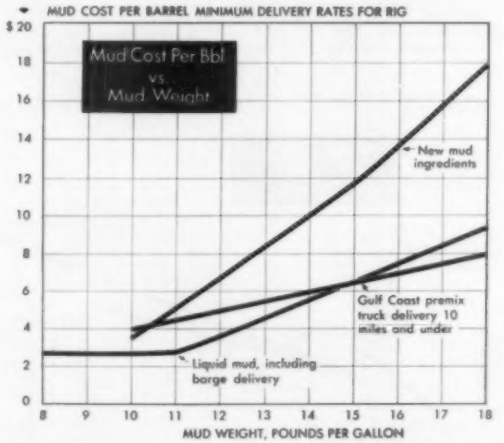


THIS CURVE is an average for South Louisiana wells; it includes location, protection pipe and electric logging. Since completion costs vary so widely, dry-hole cost is used for comparison.



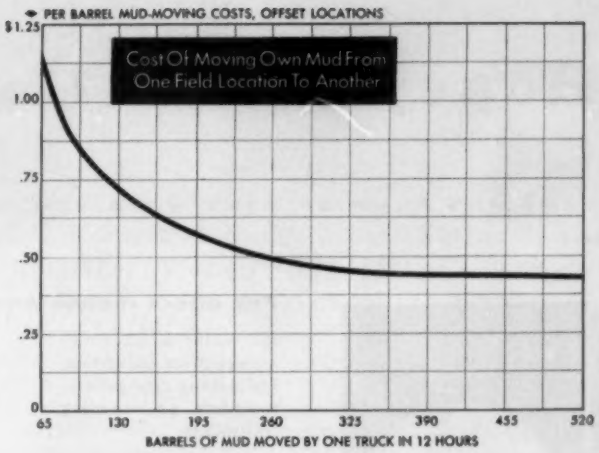
MOST SOUTH LOUISIANA drilling contracts are let on a footage basis and this curve is designed for comparison on that basis. Note that over-all drilling cost on this curve increases quite rapidly with depth.

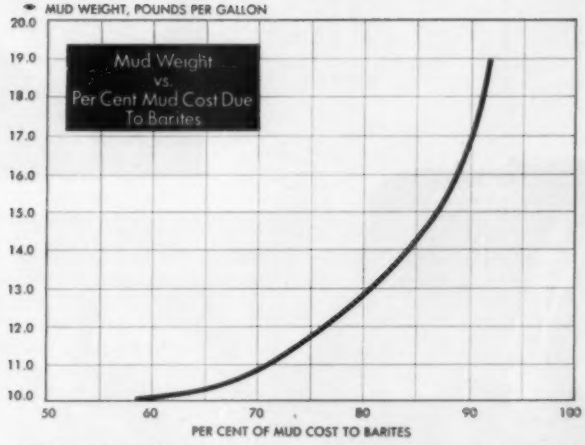
MUD COST is not the same proportion of total drilling cost at all depths. It rises rapidly with well depth. Reason for this can be found in the curves showing mud weight vs. depth and mud cost vs. weight.



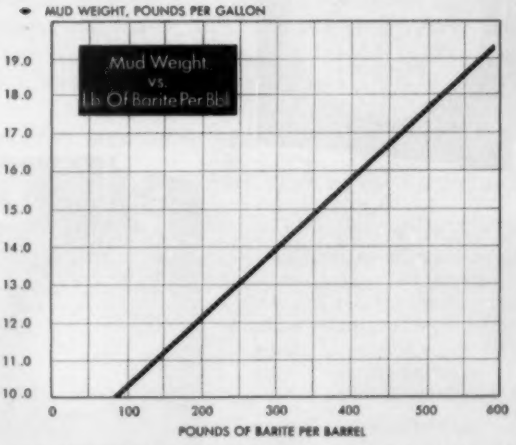
THESE FIGURES represent minimum delivery quantities for barge and truck. at less than minimum quantities, new mud ingredients become more attractive. But, big savings is making salvaged mud more common every day.

MOVING mud with a truck can be cheap. A truck can move 40,000 lb. or 65 bbl. of mud (15 lb. per gal. and under) at $15.50 per hour. Assume a 4-hr. round trip, 50 miles out and back and an hour to load and unload.

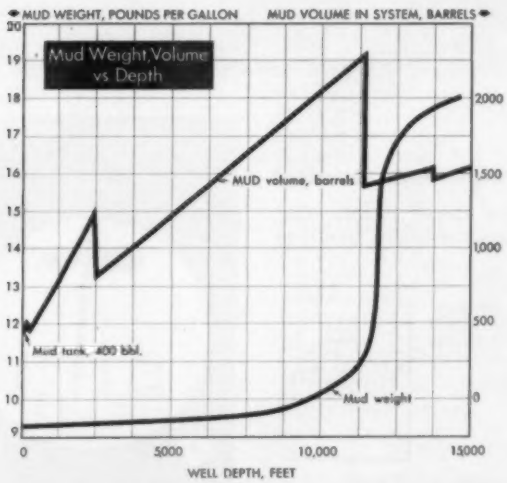




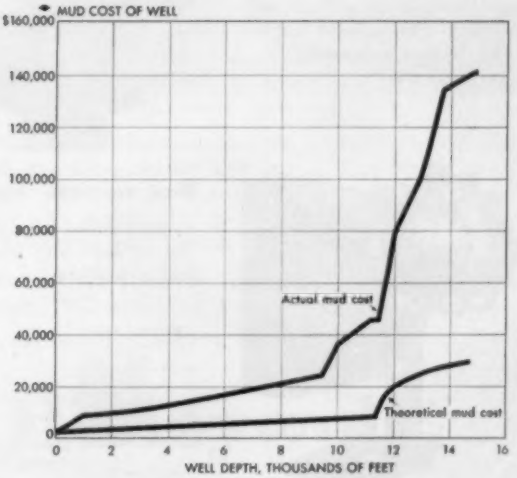
MAJOR EXPENSE of most South Louisiana muds is barites. Mud centrifuges often save money by recovering the barites and rejecting drilled solids.



FIVE HUNDRED POUNDS of barite recovered per barrel from 100 bbl. of mud would amount to 25 tons, about $1,000 worth. This shows savings possible with centrifuges and reclaimed mud.



ACTUAL MUD WEIGHTS and theoretical mud volumes in a well. Changes in mud volume are caused by setting casing strings. These curves were used to calculate the theoretical mud cost shown on the next graph.



THE THEORETICAL CURVE assumes no loss of mud and a smooth, to-gage hole. The spread between theoretical and actual costs is maintenance cost. (There was some loss of circulation on this well in the surface and conductor holes; there was none below 11,500 ft.)

Honeywell Bellows Flow Meter

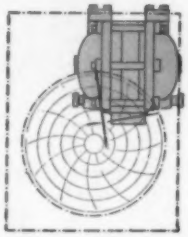
HERE ARE FOUR OF MANY WAYS YOU CAN USE THE BELLOWS FLOW METER

With an indicator or recorder—Indicators can be supplied with or without pneumatic transmission. Recorders can be one, two or three-pen instruments, with the second and third pens actuated by thermometer and/or pressure elements.

With a "blind" transmitter—the non-indicating differential pressure transmitter is used when indication is not required at the process and the variable is to be transmitted to remotely located instruments.

For direct measurement and control

the meter is integrally mounted on indicators, indicating controllers, recorders, or recording controllers.

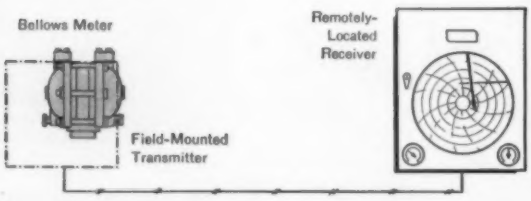


With indicating or recording controllers—All indicators and recorders can be supplied with any pneumatic control form from on-off to three-mode. Indicating controllers are also available with pneumatic transmission.

With an indicating transmitter—Scale is graduated in accordance with the flow or liquid level span of the transmitter. These transmitters are available with pneumatic control to remotely operate final control elements.

For remote measurement and control

Field-mounted transmitters, either "blind" or indicating, can be used with remotely located indicators, recorders, and controllers.



and with Tel-O-Set miniature instruments and a variety of options!

has applications unlimited

Unequaled for accuracy, stability, versatility in flow and liquid level metering

Here's the most advanced meter body available today, with advantages never before found in flow and liquid level meters. Combine the new Honeywell Bellows Flow Meter with the instruments shown on the facing page for truly superior service in metering steam, water, gas, oil and other fluids.

Some of its outstanding features:

Sensitive and accurate—Sensitive to within 0.5% of full scale . . . calibrated accuracy ±0.5% of full scale.

Leakproof—Between liquid fill and process fluid.

Automatically stabilized—Changes in meter body temperature or static pressure have no effect on output shaft position. Meter operates efficiently in ambient temperatures of minus 40°F to plus 250°F.

Unmatched convenience features—Including fast range changing in the field . . . connections for both horizontal and vertical piping . . . quick calibration and adjustment . . . easy cleaning and servicing.

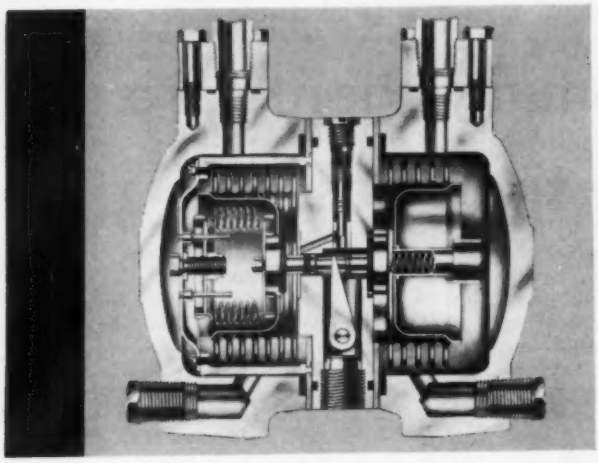
High corrosion resistance—Seamless, stainless steel formed bellows give long, trouble-free service with virtually all process fluids.

Fast, effective damping adjustment—New type pulsation check with rectangular orifice permits essentially linear damping adjustment . . . and adjustment from outside the meter body during operation.

Models are available in many ranges, for both flow and liquid level measurement and control. Get details on *all* the features of the new Honeywell Bellows Flow Meter by calling your nearby Honeywell field engineer today . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa.

● **REFERENCE DATA: Catalog C22-1**



Transfer of liquid between opposing high and low-pressure bellows converts differential pressure measurement into motion. A torque tube assembly carries the motion outside the meter body to an instrument. Therefore, changes in differential pressure change the instrument reading.

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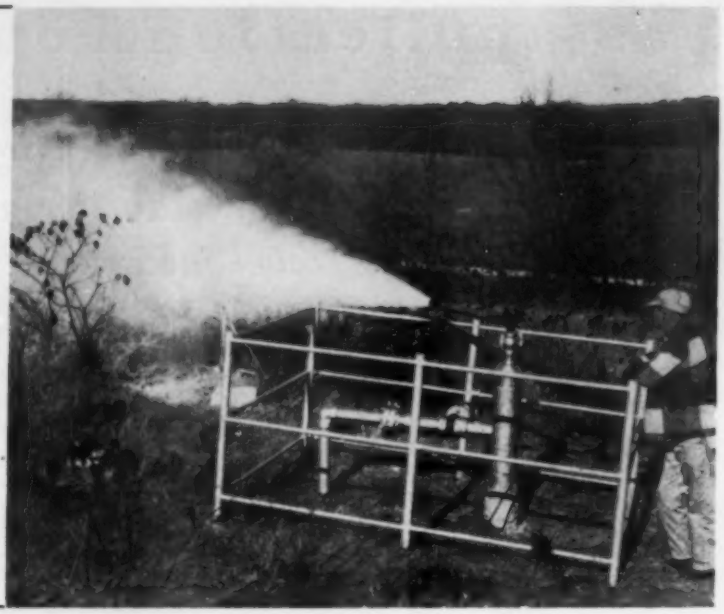
PROBLEM:

How to revive drowned gas wells and restore them to production



WATER ACCUMULATION in a gas well is easily removed as a lightweight foam after low-cost chemical treatment.

SOLUTION:

Foaming agents are low-cost treatment for tired gassers

BY H. N. DUNNING AND J. L. EAKIN
Petroleum Experiment Station,
Bureau of Mines, USDI,
Bartlesville, Okla.

WORK in the laboratory and successful field tests point the way for inexpensive methods of removing water from "drowned" gas wells. No costly workover equipment is required.

Many gas wells suffer partial or complete loss of production because of the accumulation of water in the well bore. This is true of production wells and those in gas-storage projects. Whether this drowning results from casing leakage, condensation, or actual water production, it poses an expensive problem for the gas industry.

Properly designed siphons, with or without gas-lift valve systems, commonly provide an adequate solution for extensive water production. However, the use of such devices is too expensive for marginal wells or wells in which the water accumulates slowly. Bailing and swabbing are often effective in treating such wells but these methods are tedious and require considerable equipment.

General principles . . . Foaming agents, because of their unique physical properties, cause the "capture" of gas in the column of water. The result is the gradual lifting of this water, in the form of a light foam column, by gas pressures too low to lift the water column itself. The method is therefore applicable to wells from which the water cannot be effectively removed otherwise, and in wells that are so completely drowned they do not deliver a measurable quantity of gas. The foam produced also acts as a flotation medium allowing the removal of solid particles from the well bore.

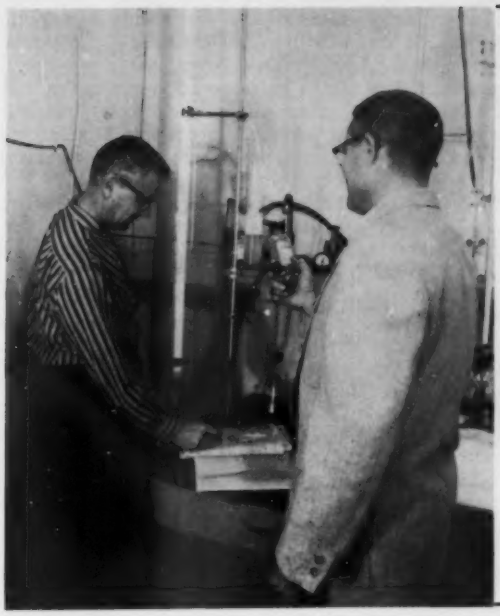
Many commercial agents are available that will foam readily in water or brines. Nonionic detergents are generally favored because they do not react with the minerals of gas-field brines and they aid in cleaning the well bore and pipe string.

Several foaming agents were studied in the laboratory by the standard Ross-Miles procedure[1] and by methods employing specially designed "bubble columns." These studies indicated several detergents that were promising for this application. The nonionic polyoxyethylated alkyl phenols were selected for field testing because of their reliable performance in the laboratory. Furthermore, several companies produce series of such detergents in which the properties vary gradually so that a highly efficient one can be selected for specific well conditions such as depth, brine salinity, and bottom-hole temperature.

Some of the detergents that appeared promising in the laboratory in addition to the polyoxyethylated alkyl phenols were Armomist, Afrox (both recommended as foam additives for air drilling by their manufacturers) and Solar.

Triton X-102, a nonionic polyoxyethylated detergent, has been tested extensively in the field. A slightly more water-soluble form of this detergent, Triton X-165, has been used to a limited extent.

The field tests made to date show that the method can be used successfully for the efficient removal of water from wells of various depths, pressures, and methods of completion. The method has been applied successfully in a wide range of casing-tubing



The authors say . . .

Treating gas wells with foaming agents can frequently:

- **Remove brine accumulations from relatively deep wells.**
- **Remove heavy oil from the sand face, casing, and tubing.**
- **Remove scale, clays, mud and solid particles from the well bore and pipe string.**

All this for five or ten dollars.

Authors Eakin, left, and Dunning, right.

combinations from 7-in. casing to ¾-in. siphons, at depths ranging from 650 to 3,400 ft. and with wellhead pressures as low as 20 psi.

Field Examples

A few typical examples of results obtained in field tests illustrate the application of the foam method. In each of these examples, Triton X-102 was mixed with an equal volume of alcohol to facilitate handling. This mixture will be referred to as the "foaming agent."

Well A, Hugoton field, Sherman County, Texas . . . This well was completed in 1950 at a total depth of 3,158 ft. with 7-in. casing set at depth of 3,041 ft. and a 6-in. liner from 3,018 and 3,158 ft. The gas-producing zone extends from 3,041 to 3,158 ft. A liquid-level measurement showed the water level at a depth of 2,843 ft., or a water column of 315 ft.

At this time, a back-pressure test showed a Q_{100} (productivity at a difference in squared pressures of 100,000) value of 45 M.c.f.d.[2] After these tests, 10 gal. of the foaming agent was lubricated into the well, preceded and followed by 5 gal. of water. A few minutes of gas production showed that the foaming agent was not adequately mixed with the well-bore fluids. Therefore, an additional 5 gal. of foaming agent was injected and the well shut in overnight.

The well was opened to the atmosphere at 9:15 a.m. and by 3 p.m. it had effectively been cleared of water and the liquid level was gaged at a depth of 3,088 ft.

The Q_{100} value of the well was then gaged at 70 M.c.f.d. A repetition of the test a week later, after some water had accumulated in the bore, again lowered the water level to 3,090 ft. The results of these tests indicate the 68-ft. water column remaining in the well is below the gas-producing zone. This treatment removed 245 ft. (about 9 bbl.) of water from a 7-in. casing, at a depth of about 3,000 ft. with a reservoir pressure of about 300 psi.

Well B, Hugoton field, Texas County, Oklahoma . . . This well was drilled in November 1957, with 5½-in. casing cemented at a depth of 2,721 ft., perforated from 2,661 to 2,706 ft. Because of the high rate of water production common to the immediate area, a string of 1¼-in. tubing with a gas-lift valve was installed to 2,711 ft.

Except for tests made in an effort to place the well on production, it had been shut in since completion. A test in January 1958, showed the well had a gas-productive capacity of 24 M.c.f.d. and a water-production rate of 34 gal. per day. The siphon had not been effective in removing the produced water. For all practical purposes, the well was "dead" prior to the test.

Ten gallons of the foaming agent was pumped into the well through the siphon. This solution was washed down the siphon with 5 gal. of water and the pressures equalized between the siphon and casing. After an hour, a small amount of gas was allowed to flow to the line to mix the agent with the liquids in the well. After 2 hours the casing was shut in and the siphon opened to the atmosphere. Almost immediately foam and water began to flow from the siphon. The siphon was left open overnight and several barrels of water were produced. Measurements of casing pressure the next morning showed that the well had been cleared of water and was ready for regular operation.

In this test, water was successfully removed from the well by the foam method through 1¼-in. tubing at a depth of about 3,000 ft. and a pressure of about 300 psi. This example illustrates the use of foam to kick off a dead well by activating a siphon system that previously was ineffective.

Well C, West Panhandle field, Moore County, Texas . . . This well was completed in 1953 with 5½-in. casing plugged back to a depth of 3,282 ft. The casing was perforated opposite a brown dolomite formation from 3,137 to 3,241 ft. The well is equipped with a tapered siphon string composed of 1,005 ft. of 2-in. plastic-lined tubing at the top, 1,216 ft. of 1½-in. plastic-lined tubing below that, and 1,023 ft. of 1½-in. unlined tubing on bottom. An ⅛-in. jet was installed at a depth of 3,131 ft.

The well was shut in overnight before the foam treatment and then 10 gal. of the foaming agent was pumped into the well through the siphon. This was washed down the siphon with 10 gal. of water. Pressures were equalized between the siphon and casing and gas was allowed to flow from the casing into the pipeline at a low rate to draw the agent down the siphon and mix the fluids. After 1½ hours

the siphon was opened. Twenty minutes later the siphon began to produce slugs of a heavy emulsion of detergent, oil, and water. This continued for 10 minutes and was followed by a steady stream of oil and water. An estimated 275 gal. of liquid containing 10% heavy oil was produced in this manner. After this production, the well was turned into the line.

This example illustrates another effect of the foam treatment. Since the foaming agent (Triton X-102) also is an effective detergent, it aids in emulsifying heavy oils with the water so that the well bore, siphon, and sand face can be cleaned of the heavy oils that sometimes reduce the productivity of the well.

Well D, Longton storage pool, Chautauqua County, Kansas . . . This well was completed in 1947 with 5⅞-in. casing set at a depth of about 663 ft. at the top of the "Salt" sand (Pennsylvanian). The field has been used for gas storage since 1939. Formation pressures at the end of the injection and withdrawal periods have averaged about 155 and 125 psi., respectively. The storage operation is being abandoned, however, and the reservoir now is being stripped of its remaining gas content. The formation pressure was 92 psi. at the time of the foam test. The production of water with the gas during regular storage operations was not a problem. However, more and more water is produced as the formation pressure declines. Just before treatment, the open-flow capacity of the well was 330 M.c.f.d. and the water level in the manometer used during the open-flow test pulsated from 3 to 9 in. indicating water in the well bore.

The well was shut in, and 2 gal. of water pumped into it to wet the casing before 3 gal. of the foaming agent was injected. The foaming agent then was washed down the casing with 5 gal. of water. The well fluids were allowed to agitate for 45 minutes by bleeding a small amount of gas to the atmosphere. Foam had reached the surface shortly before the end of this period. A gate valve on the wellhead was then opened; within 30 minutes the well was clean and dry. The open-flow capacity of the well after this treatment was 360 M.c.f.d. and the water in the meter manometer pulsated only 0.2 in. The well was checked by bailing about 2 weeks after the treatment and found to be free of water.

General

The brines removed from the wells described above contained from 100,000 to 250,000 p.p.m. total solids, and up to about 10,000 p.p.m. calcium and magnesium. Triton X-102 was highly effective as a foaming agent in these brines. However, use of the more water-soluble Triton X-165 is indicated for the heaviest brines.

The cost of treatment ranged from about $3 to $10.

Continuous application . . . The wells discussed so far were treated by batch method, but the system may also be applied to continuous water removal if the foaming agent is introduced into the well continuously by a chemical feeder. Provisions must be made for breaking the foam and separating the produced water from the gas.

In addition to removing water from well bores and cleaning them of heavy oils, the foam treatment is very effective in removing solids such as scale and mud from wells. This probably is due to the flotation effect of the foam.

Summary

If the following precautions are observed, good results should be obtained on many gas wells at a minimum cost:

1. Enough foaming agent should be either pumped or lubricated into the well to form at least a 0.2% solution with the water in the well.

2. The foaming agent should be thinned with a solvent such as alcohol, to allow easy handling and rapid flow down the pipe. The mixture of foaming agent and alcohol should be washed into the well with additional water.

3. The foaming agent must be mixed with the water to be removed. This may be done by "rocking" the well if it contains tubing or a siphon or by allowing a shut-in period of about an hour or longer if the well contains only casing. It is preferable to pump the agent into the annulus if water is to be produced from the tubing, or vice versa, to insure that the foaming agent reaches the bottom of the water column.

Limitations

1. The effects of the batch treatments described are temporary. Continuous addition of detergent and separator facilities would be required for continuous water removal.

2. The effects of this method are limited primarily to the well bore and pipe string. Water blocks in the formation will not be markedly affected by the treatment.

Acknowledgment

This work was conducted cooperatively with the American Gas Association. The authors are indebted to the following committees and their respective chairmen: Supervising committee, C. C. Ingram, Oklahoma Natural Gas Co.; underground storage committee, N. P. Chesnutt, Southern Union Gas Co.; and subcommittee on deliverability problems, N. M. Hulings, Jr., Oklahoma Natural Gas Co. The authors also are indebted to R. V. Smith, Phillips Petroleum Co.; R. T. Widney, Cities Service Oil Co.; C. W. Studt, Union Gas System, Inc.; and C. J. Walker of this station for their cooperation in this work.

References

1. McCutcheon, J. W., "Synthetic Detergents," p. 77, MacNair-Dorland Co., New York, 1950.

2. Walker, C. J., and Dunning, H. N., "How Gas Storage Wells Behave," Pipeline Engineer, Vol. 30, June 1958, p. D-36.

BOOKS

ACCOUNTING PRACTICES IN THE PETROLEUM INDUSTRY. By Robert H. Irving, Jr., and Verden R. Draper. Published by Ronald Press Co., 15 E. Twenty-sixth Street, New York 10. 247 pp. $6.

Accounting in the highly specialized and dynamic petroleum industry presents many challenging problems and procedures which often have no counterparts elsewhere. Consequently, a great number of varied accounting practices have been developed for the transactions which are unique to the oil industry.

In this book all the generally accepted alternative methods of accounting for these transactions are fully explained in their many special applications.

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OIL AND PETROLEUM YEAR BOOK. Published by Walter E. Skinner, 20, Copthall Avenue, London, E.C. 2. 800 pp. $7.

The 1958 edition of this work contains complete, up-to-date particulars of 1,070 of the principal British, American, Canadian, and foreign oil companies in all parts of the world, and covering all branches of the industry.

A 21-page section gives the names of 730 managers, engineers, and agents, with their addresses and the companies with which they are connected.

Also included are crude-oil and natural-gasoline tables, showing annual world production, by countries, from 1948 to 1957.

Another section, a buyers'-guide division, lists 1,000 manufacturers of plant, equipment, and accessories.

Two maps are included in the volume, showing the Trans-Canada natural-gas-transmission system, and Middle East oil fields, refineries, pumping stations, and pipelines.

Note: The Oil and Gas Journal maintains a book department. Write to the READER SERVICE DEPARTMENT, P. O. Box 1260, Tulsa 1, for copies of the book list. Often books reviewed here may be purchased from this source.

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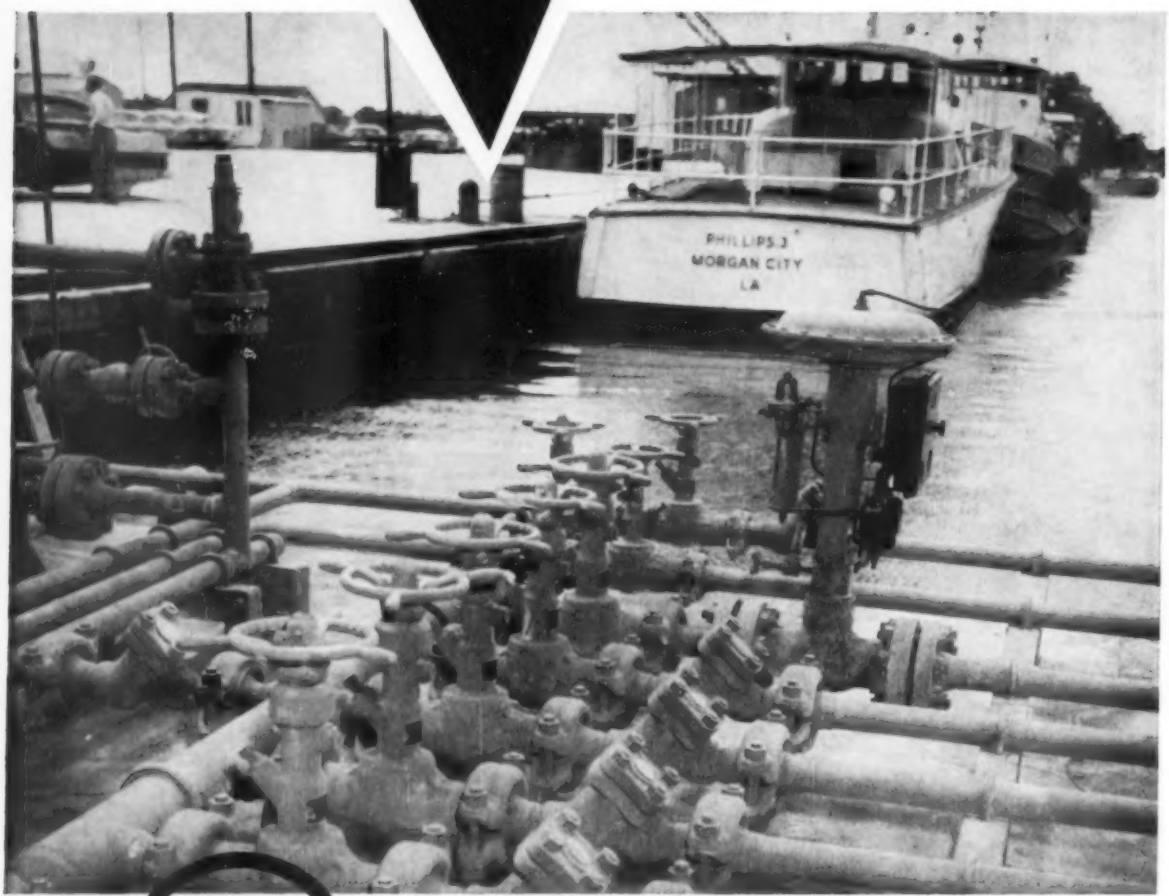

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STORAGE TANKS are a vital part of every operation within the refinery for storage of feed, intermediate products, finished products, and many nonpetroleum items. Most of these tanks are in liquid service at atmospheric pressures. Many, however, operate with pressures up to about 70 psi. For higher pressures, such as at a propane-storage plant, multiple units of drums are used for storage.

Selection of Storage Tanks

The most common form of storage tank is the cone-roof tank. Cone-roof tanks are simply vertical cylinders with flat bottoms usually resting directly on the ground and equipped with conical roofs supported by structural-steel columns and rafters. The conical roof from which the type name is taken has a slight slope for the purpose of water drainage.

Cone-roof tanks operate at atmospheric pressure and are equipped with vents. These vents maintain atmospheric pressure above the liquid during filling, emptying, and changes in volume of vapors above the liquid level resulting from atmospheric-temperature variation. Cone-roof tanks are designed for only a few inches of water pressure. For this reason they cannot be used to store highly volatile liquids.

Since cone-roof tanks are connected to the atmosphere through a vent, losses will occur due to evaporation of the liquid in the tank. The amount of such loss will increase for lighter liquids and for higher temperatures. Losses by evaporation will result from filling and emptying a tank and from tank "breathing," that is, inward flow of air through the tank vent at night when the tank is cool and outward flow of air and vapor mixing during the day when the tank heats up.

Four types of storage tanks designed to reduce evaporation losses are:

1. Pressure storage vessels.
2. Gas holders.
3. Floating-roof tanks.
4. Spheres, spheroids, etc.

The vapor pressure of the stock to be stored determines the type of storage vessel used.

Pressure storage vessels . . . Pressure storage vessels have been discussed under the subject of "drums." The application to a specific storage problem is to design the vessel strong enough to withstand the vapor pressure of the material to be stored. Butane, for example, at storage conditions of 125° F. would require equipment designed for 60 psi. Propane would require a design for 225 psi. Ethane would require a design for 1,000 psi. Obviously, it is not very practical to store materials as light as ethane in the liquid form at normal temperatures.

Very light hydrocarbons and other gases that require excessive pressures to store as a liquid, may be stored as a gas in a gas holder. Gas holders are constructed with a closed top and are sealed in water around the bottom. The gas holder operates by moving up and down as the gas is pumped in or taken out. This type of storage is limited in capacity because the material stored is a gas at relatively low pressure, therefore, it is impractical to build equipment large enough to handle any appreciable amount of gas. For example a 400-M.c.f. gas holder contains only the equivalent of 166 bbl. of liquid methane.

Floating-roof tank . . . A floating-roof tank is a storage tank that has no vapor space about the liquid contents in the tank because the roof which floats on the oil moves up or down as the oil is pumped in or out of the tank. The floating roof is constructed of steel with pontoons built into its large, flat structure which reaches from wall to wall of the tank.

The edges of the floating roof are constructed of a metal ring which is forced against the tank wall and is attached to the floating roof by a heavy gastight and weatherproof fabric. The roof is accessible by a ladder that is hinged at the top rim of the tank and rolls at its bottom on the floating roof. Rain water drains to a low point on the roof and may be removed either by allowing the water to fall through the oil contents of the tank to the tank drain or the water may be piped from the roof drain to an outlet near the bottom of the tank by means of a flexible jointed pipe.

Vertical guide bars attached to the shell of the tank extending into a slot in the roof prevent rotation of the roof. Materials with 13-psi. R.v.p. or higher will vaporize and cause gassing in floating-roof tanks and therefore should be stored in pressure storage tanks.

Spheres and spheroids . . . Spheres, spheroids, and hemispheroids are pressure storage tanks. Spheres are perfectly circular when viewed from any direction and some tankage of this type will store liquids with 70 psi. vapor pressure. The diameter, the vessel plate thickness, and other design details will determine the exact allowable pressure in any pressure vessel. Normally spheres are designed for the greatest pressures, spheroids next, and hemispheroids the least pressures.

A spheroid gives the appearance of a flattened ball in that it has a circular shape when viewed from above but from a side view the width is greater than the height.

Hemispheroids have vertical side walls like ordinary atmospheric-pressure storage tanks but the top and the bottom of hemispheroids are dished to resemble the heads of a pressure drum. Vessels of this type are used for high-vapor-pressure naphtha storage. Hemispheroids are protected from excessive pressures by water seals while spheres and spheroids have safety valves.

Any of the pressure storage tanks presents a problem when filling or pumping out. If filled too quickly, excessive pressure may develop and cause the safety valve to release. If emptied too quickly, the vacuum relief may open and allow air to enter the vessel. Tank vents are provided with flame arrestors.

Gaging devices for pressure-storage vessels are totally enclosed float-and-tape type which can be read through a viewing window. Sample connections and thermowells are normally provided in pressure-storage equipment.

This material taken from process-training-program manual, Baton Rouge, La., refinery of Esso Standard Oil Co.

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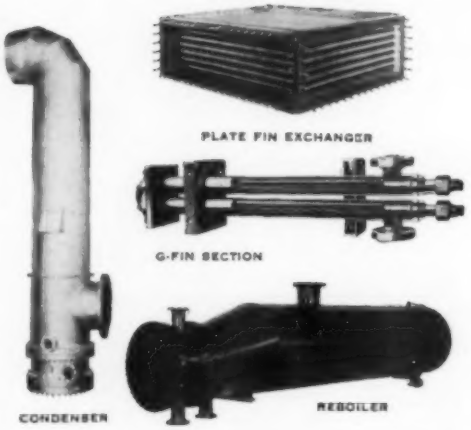

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Questions on
TECHNOLOGY

How size of fraction affects pour point

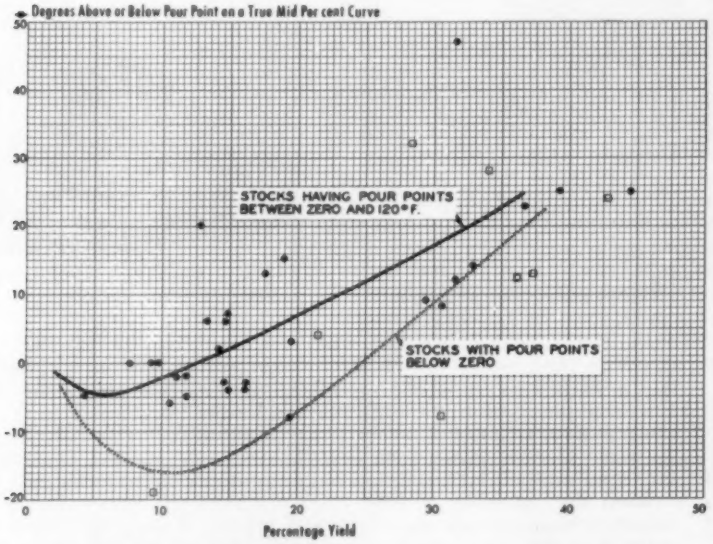
BY W. L. NELSON
Technical Editor and Petroleum Consultant

What is the effect of width of boiling range on pour point? As high-boiling waxy material is included in the stock, does the low-boiling material that is also included keep the pour point from rising? —S.W.T.

Although very wide fractions (above about 20% of the crude oil) have higher pour point than narrow fractions, the situation is not altogether clear (see chart).

The question might have been rephrased as "Can pour point of wide-boiling-range fractions be obtained from mid Per cent curves of pour point?" If the pour points of short fractions (5% or thereabouts) of a crude oil are plotted as a mid per cent curve, the pour points of wider fractions are higher and lower than points on the mid per cent curve as shown in the figure. No clear pattern of behavior is evident except (1) very large fractions have higher pour points than narrow fractions, and (2) intermediate size fractions (5-20%) may have lower pour points than a mid per cent curve indicates.

The experimental points of the chart are scattered widely. These variations are due in part to variations in the distribution of waxy material in the crude oils and to the inadequacies of the pour-point test. The very highest points on the chart are for crude oils in which the amount of paraffin wax is abnormally high. It is also possible that trace amounts of materials which tend to inhibit crystallization may have contributed to the variation. However, all of the samples were distilled materials and hence the main bulk of asphaltenes (crystallization inhibitors) was eliminated from the samples during distillation. The curves sketched on the graph to indicate the general trend were curved upward at yields of 0-5% because such sizes of fractions are the basis of the comparison, i.e., they are used to draw the mid per cent curve.



EFFECT OF BOILING RANGE on the pour points of distilled materials.

Costs of Oil-Field Equipment

Have you published any costs on oil-field equipment?—J.M.C.

The following articles or items have been published on the cost of oil-field equipment. The most complete information, i.e., the list of 29 items published by the Bureau of Labor Statistics (Wholesale Prices and Price Indexes, monthly), unfortunately gives only indexes. Possibly the Bureau of Labor can supply the costs upon which the indexes are based. The composite index of the 29 items is published each quarter on the Itemized Cost Index page of The Oil and Gas Journal (January, April, July, and October).

1. Costs of Rotary Drilling Equipment (a list of the 29 items of the Bureau of Labor), October 10, 1955, p. 267.
2. Storage Tanks Are Major Refining Cost, Costimating, No. 3, December 5, 1955.
3. Petrochemical and Small Tanks (original), Costimating No. 6, November 25, 1948.
4. Pipeline Construction Costs (Gas and Oil Stations), Costimating No. 22, December 3, 1956.
5. Over-all Plant Costs (Natural Gasoline Plants), Costimating No. 28, April 15, 1957.
6. Cost of Buildings (original), Costimating No. 22, March 17, 1949.
7. Compressors (original), Costimating No. 36, June 23, 1949.

Correction: Who Makes Boron

IN THE November 24, 1958 issue, page 89, Union Oil Co. of California was listed as a licensee for the use of boron. This is an error. Richfield Oil Corp. is the exclusive licensee in its marketing area and Union Oil does not market "boron" gasoline.

It was also stated that boron, when used with highly leaded fuels, is most effective with straightrun and alkylate fuels but it has little antiknock effect on high aromatic fuels such as catalytic reformates. This is generally true except that a substantial improvement in road-octane performance has been established (Hughes and Hook, Boron—New Improvement Agent, Refining Engineer, July 1956, p. C-10) when boron is used in highly aromatic fuels. Boron also causes a marked decrease in knock caused by pre-ignition triggered by combustion-chamber deposits.

On the Job

PIPELINING

Pipe failures: causes and effects

—and prevention by proof-testing

ONE of the most important developments in the study of line-pipe failures is the use of chevron markings present on the fractured surface of the failure for detecting the origin of the failure. The chevron markings point to the origin of the failure and when the cause of failure has been established it has been possible to take preventative steps in many instances and failures which would otherwise occur were prevented.

Failures may originate in a defect such as a gouge or laceration resulting from construction machinery. Also, defects may occur in or adjacent to the longitudinal weld or in seams, laminations, slivers, or scabs. Most of these defects originate in the manufacturing process although the notched area adjacent to the weld and the body of the pipe may be damaged during transportation.

There have been a number of gas-pipeline failures during proof testing which have been over 500 ft. in length. Various opinions have been expressed regarding the cause of these long failures. Some have expressed the view that if the lines were properly purged or tested with air that the long failures would not have occurred. Others have expressed the view that the construction characteristics and the properties of the steel pipe in addition to the temperature, size of pipe, and pressure on the line may be used to explain the behavior of the pipeline in the presence of a harmful defect.

There have been long failures when testing with gas in which a fire did not occur. If long failures were due to explosive mixtures of gas and air in the line, fire should occur. Experiences with failures in air testing have not been made available and apparently long failures have not occurred under these conditions. Also, long failures have not been reported in the literature after the gas pipeline has been in service and properly purged providing hydrogen embrittlement is not encountered.

This does not mean, however, that long failures cannot occur in service. When a failure occurs in a pipeline and the fracture is in cleavage, the velocity of the crack will depend on the amount of energy available in the pipeline, the properties of the material and other factors. The cracks may travel at speeds up to 6,600 ft. per second, which has been measured in large-plate tensile specimens.

When the crack's velocity exceeds the speed of sound in natural gas, 1,300 ft. per second, the crack may travel indefinitely except for other factors which would change this condition. The impact properties of the material which depends on temperature may influence the behavior of the crack. Other factors are the physical characteristics of the pipeline, such as bends, the amount of overfill and the energy available for rupture of the pipe.

It has been observed that several cracks may be traveling simultaneously in a pipeline failure and that in certain cases these cracks may be in the shape of a sinusoidal wave. It is quite possible that a critical velocity is associated with a sinusoidal wave and that the wave length may vary considerably in a pipeline failure.

When the fracture is in shear the velocity is apparently low and a sinusoidal wave does not occur. When the fracture is in cleavage with very rapid fragmentation a sinusoidal wave would not be observed due to the high velocity and large number of different cracks at the same time in the pipeline.

Usually, when a pipeline failure terminates, the fracture changes from cleavage to shear and the path of the shear fracture is such that it tends to choke off further rupturing in the pipe. The cracks traveling in the circumferential direction of the pipe starting with an angle of approxi-

LONG-DISTANCE RUPTURING of pipe tested with gas.

PIPE AT BURST during burst testing with water outside of test pit.

From "Technical Development — High Strength Line Pipe," by W. A. Saylor, chief metallurgist, Consolidated Western Steel Division, and A. B. Wilder, chief metallurgist, National Tube Division, U. S. Steel Corp., presented at Denver ASME meeting.

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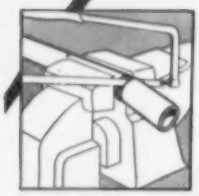
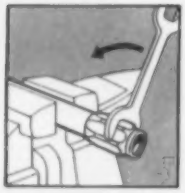
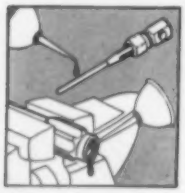


1. Cut hose to desired length



2. Screw on socket counterclockwise



3. Oil inside of hose and insert assembly tool

4. Screw swivel nipple or male fitting into socket and remove tool

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mately 45° with respect to the longitudinal direction of the pipe chokes off the failure. It may also be possible to observe in cleavage fracture a shear lip which may be related to the velocity of the crack.

To fully understand pipeline failures, considerably more research work of a fundamental nature will be required. However, it has been observed that failures originate in defects and therefore it is desirable to develop a better understanding of a harmful defect. This has been accomplished to a marked degree by observing the origin of various pipeline failures.

If the cause of a pipeline failure can be controlled (and there has been considerable progress in this direction) the importance of fully understanding the behavior of pipeline failures is of less importance. In studying pipeline failures, it has been observed that in certain cases a failure may occur at the notch adjacent to the longitudinal weld bead. These types of failures have been the subject of considerable thought and investigation, and, as a result, it has been determined recently that they may be associated in certain cases with the phenomena of fatigue occurring during the rail transportation of the pipe.

Laboratory studies during the past year have disclosed these fatigue-type defects can be produced in ordinary cyclic stressing and also in resonance. In addition to observing fatigue-type failure in line pipe these have occurred during rail transportation of structural members.

It is not practical to eliminate all defects in pipelines, and therefore it becomes necessary to only consider the harmful defects in the manufacture of pipe and construction of the pipeline. The importance of proper inspection is recognized and considerable progress is being made in this area.

Testing of Pipelines

The most important factor, however, in the construction of a pipeline is proper proof testing. To eliminate long failures, water should be used. Air could be used to eliminate explosive mixtures, but it has not been established that the use of air would eliminate a long failure in proof testing. It has been proved, however, that water testing will do so.

In the construction of pipelines, low ambient temperatures may prevent proof testing with water. Use of an antifreeze at very low temperatures would be costly and therefore not practical. It should be noted, however, that the possibilities of a very long fracture are increased if a defective piece of pipe is encountered during gas testing at low temperatures. Pipelines which must be proof-tested at low temperatures may be tested with gas and operated at a low pressure with circumferential stresses, possibly not exceeding 10,000 psi., and later hydrostatically tested at the required pressure so that the line may be operated at its design pressure.

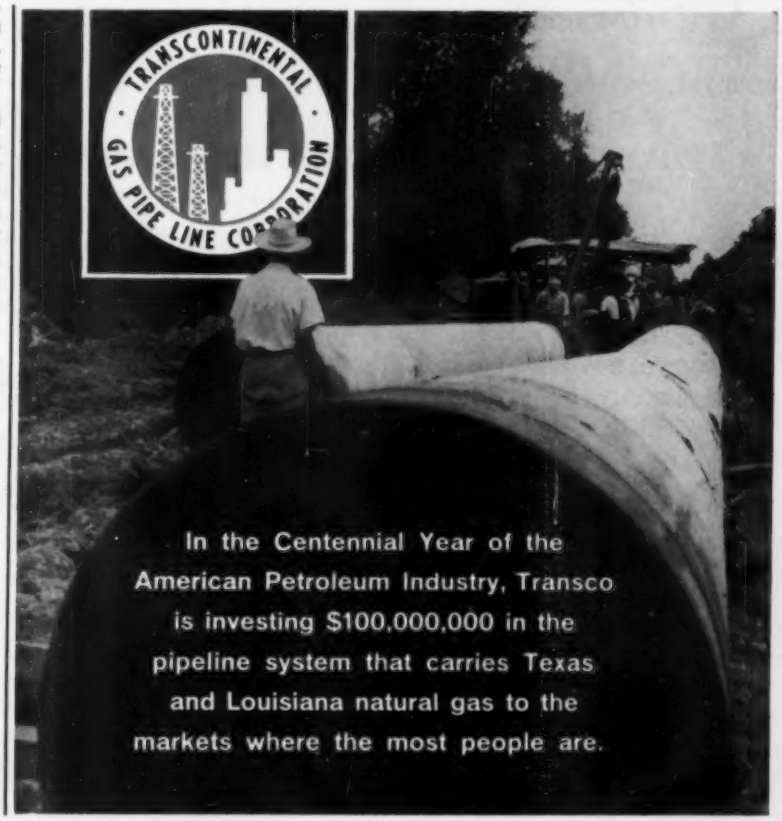
In the hydrostatic testing of a pipeline, higher testing pressures than are required in the codes for gas testing may be used. This will provide a safer pipeline due to the elimination of additional defects if they are present. However, it would appear that the test pressure should not exceed the specified minimum yield strength in accordance with the specification for the material. There have been pipelines tested to the actual yield strength of the material. This would mean that the lowest yield-strength material would actually yield during testing of the line. Hydrostatic testing would be required to determine the yield strength during the testing of a pipeline. It is our understanding that pipelines tested under these conditions, in most cases, have been satisfactory in service.

Hydrostatic testing is not only a relatively safe testing procedure, but also the break that may occur if a defect is encountered in the pipeline will be very short. However, if pipe is expanded during hydrostatic testing beyond the yield strength without indicating yields, the material may indicate satisfactory service but would be a potential source of failure at some future time due to the excessive expansion of the pipe. It is therefore desirable to not hydrostatic test a pipeline above the minimum yield strength specified for the material. Satisfactory public relations are maintained with hydrostatic testing of gas pipelines because explosions, for example, are not encountered and the possibilities of loss of human life are reduced to a minimum.

Hydrostatic Burst Testing

Burst tests of large-diameter line pipe have been conducted by M. A. Scheil et al., at approximately —50° F. on API Std. 5LX Grade X52 line pipe. The ductility as measured by the increase in diameter of the pipe after bursting was similar to the results obtained in a large number of burst tests at ambient temperatures. However, this measure of ductility is not necessarily associated with pipeline behavior of low temperature in the presence of a notch. The ductility measured would be similar to that obtained in an unnotched tension specimen at —50° F.

Burst tests of production pipe and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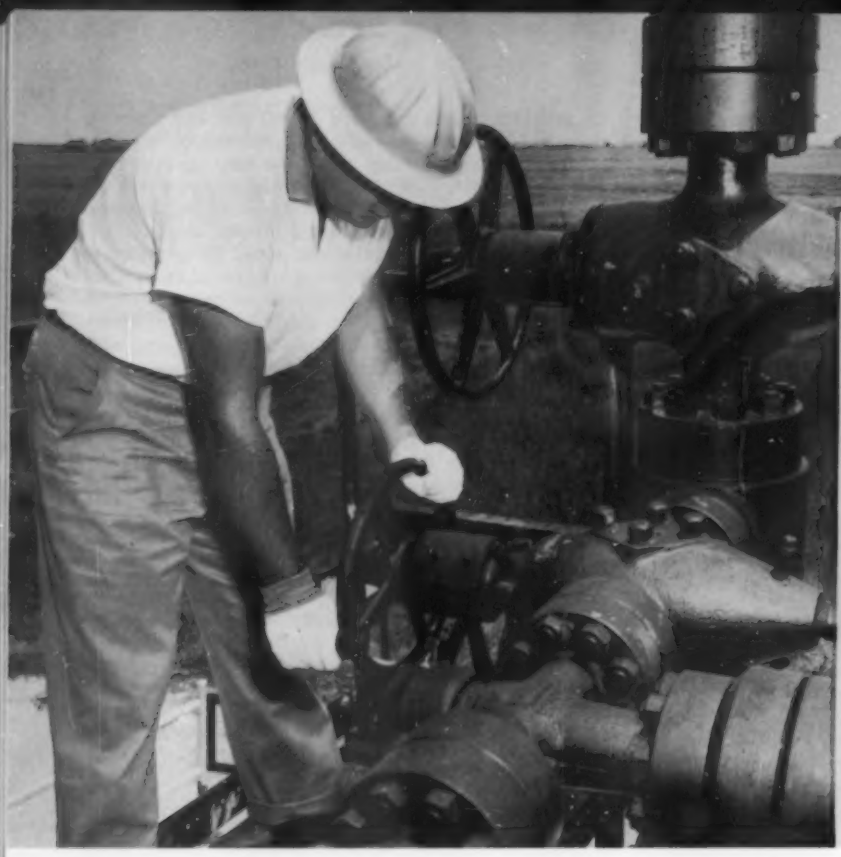

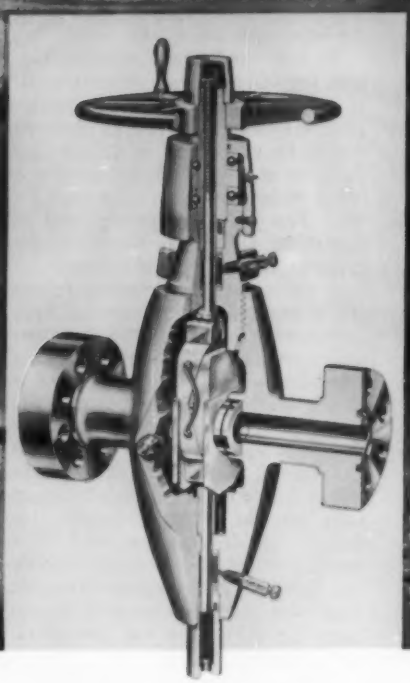

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observations of field failures indicate a cleavage type of fracture obtained in the area of the origin of failure in high-strength line-pipe steel. The fracture at the ends of the failure is usually a shear-type fracture. These observations indicate high-strength line pipe usually behaves in a brittle manner during failure at ambient temperatures. The Charpy V-notch impact test results of many production heats of API Std. 5LX Grade X52 line pipe support this contention.

It is interesting to observe that the behavior of high-strength line-pipe steel is similar to pressure-vessel steel. The comparison is based on the recent work of H. B. Hamel, which summarizes the properties of pressure-vessel steels. To experience brittle field failures, a notch, sufficient stress and low temperature are required. This emphasizes the necessity of eliminating harmful notches from a pipeline and this objective may be achieved to a remarkable degree by proper proof testing of the line before it is placed in service.

In examining the fracture of the tests burst at —50° F. a cleavage-type fracture was observed.

This type of fracture was similar to the fractures observed in a great many burst tests conducted on Grade X52 at ambient temperatures of various sizes and thicknesses of line pipe. When the Grade X52 pipe was burst-tested at temperatures exceeding 180° F., the fracture was in 45° shear and the cleavage-type fracture was not observed.

These results would be expected from the transverse Charpy V-notch values. The results obtained in the burst test of Grade X52 line pipe at —50° F. were performed using a brine solutions. The amount of energy in the pipe being tested with brine solution would be very low in comparison with a similar test using gas.

The conditions of testing would not, therefore, be similar to gas pipelines operating at —50° F. In a gas pipeline operating at —50° F. with the type of material being studied it would be expected that fragmentation would occur at the bursting pressures.

If a harmful defect were present in the pipeline at —50° F. it is possible the crack would travel very long distances if rupture occurred at a high pressure during proof testing of the pipeline. If rupture in a pipeline at —50° F. occurred at a sufficiently low pressure during proof testing it is quite possible that the crack would not travel due to insufficient energy for crack propagation. The stress associated with crack propagation has been studied by T. S. Robertson.

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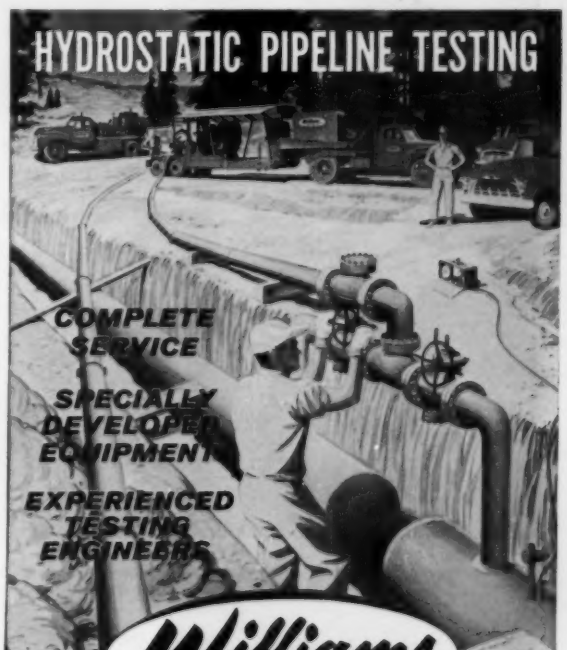

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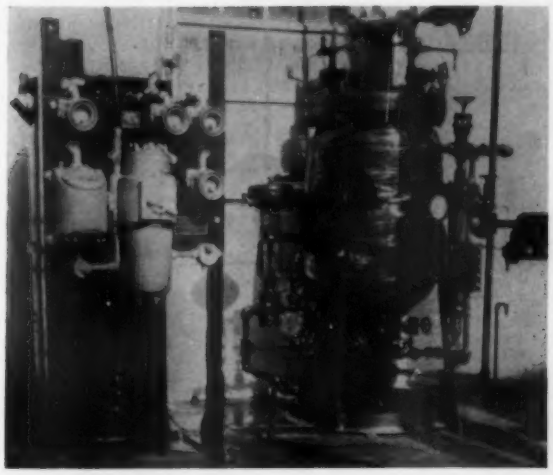

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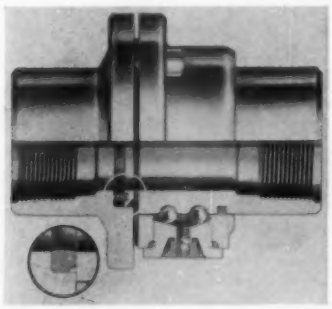
The extinguishers are approved by Underwriters' Laboratories and Factory Mutual. **Write or call: Walter Kidde & Co., Inc., 675 Main Street, Belleville 9, N. J., for details on portable dry-chemical fire extinguishers.**



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The design of the joint is such that packing seals may be replaced without removing the joint from a line. For general service, molded elastomer packings, including Viton A, are available. For steam, hot gas, and certain chemicals, a disk seal is used. When used with disk seals, the sealing chamber contains inconel springs to exert a uniform pressure on a ring. When used with molded packings, the springs and pressure ring are easy to remove and the packing inserted.

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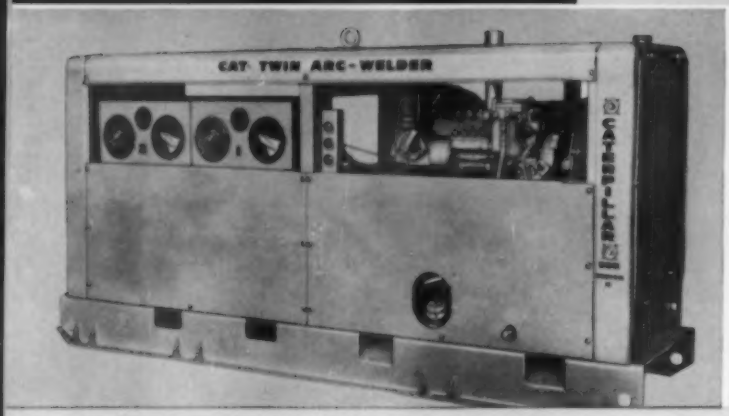
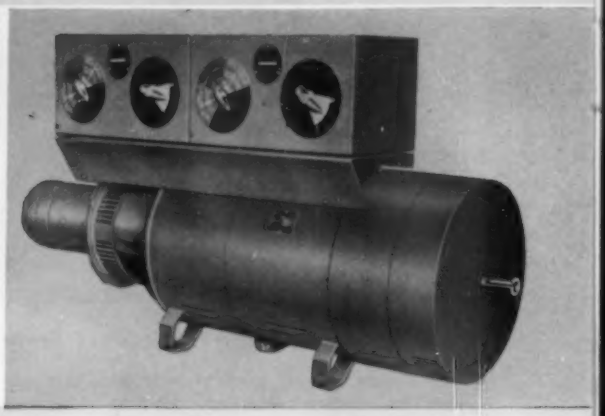


Powered by the Cat D311 (Series H) Engine the new, compact Twin Arc-Welder has ample power and capacity to handle two 300-amp. arcs. It costs less and has faster recovery. Operators know it has hot arc on contact with no waiting for the machine to come up to speed. Operation is smoothly uniform and control is completely automatic.



Reliable Cat power drives twin Lincoln welding generators and features two independent control panels permitting different welding operations at the same time. The single unit, two-arc package is only 35 inches wide to permit placing two side by side on the average truck bed—enough power to supply four men.

By powering this new electric arc welder with a D311 (Series H) Engine, Caterpillar has improved on the performance of the D315 powered welder. It's 1,300 pounds lighter, 20 inches shorter, 3½ inches lower and 4½ inches narrower—a lighter, more compact, more transportable unit that can meet the most exacting pipeline schedules and the toughest terrain. Big news, too, is its lower purchase price.

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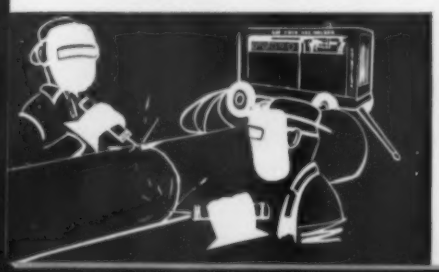
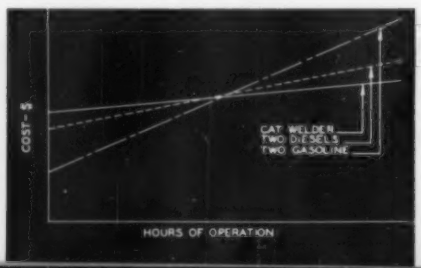


LOWER OPERATING INVESTMENT over life of a welding unit is important. A Twin Arc-Welder saves money over other makes.



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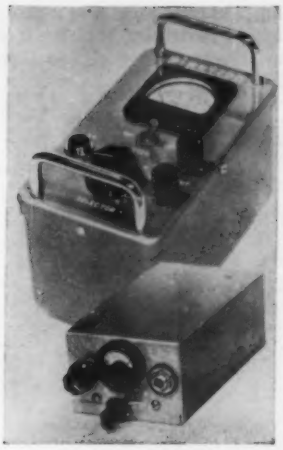

Detector inspects coating on pipe

. . . buried underground, and it locates pipe and shorts between pipes. A portable detector, it consists of a transmitter, receiver, search coil, and several accessories.

The instrument locates accurately small flaws or holidays in the protective wrap of pipe several feet deep, the maker claims. It can be used to inspect a coating just after burial to find any damage caused by backfill or other defective spots. It can also be useful in regular maintenance inspection to avoid leaks and reduce upkeep and cathodic protection costs. **Write or call: Pipetron Co., 12926 Saticoy Avenue, North Hollywood, Calif., for details on pipe detector.**

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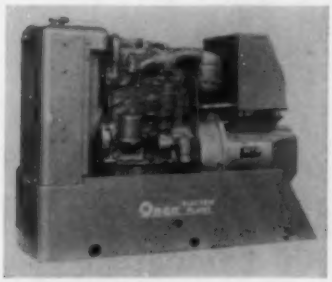

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. . . plant comes in two sizes for producing either 10 or 15 kw. of power—either stand by or continuous. The Series DZB plant can serve as a source of quick-starting auxiliary power for construction or oil-field use.

The prime mover is a three-cylinder, 37 hp. (at 1,800 r.p.m.) engine. It has a distributor type of direct-injection pump with built-in fuel-transfer pump, replaceable fuel filter, hand-priming pump, and 12-volt battery-charging generator.

The generator is direct-connected to the engine and is a single-bearing, four-pole, revolving-armature type. **Write or call: D. W. Onan & Sons, Inc., Minneapolis, Minn., for details on Series DZB electric plants.**

●

Clamp gives fast repair of pipe

. . . in diameters of 2 and 3 in. Made of stainless steel with malleable-iron lugs, the Model 360 clamp is easy to install to repair either full breaks or holes in asbestos-cement and cast-iron pipe. It can also serve as coupling.

Broken ends on asbestos-cement pipe can be evened and coupled by the clamp. And too, odd lengths of plain-end cast-iron pipe can be coupled with the lugs on only one side.

The gasket used with the clamp

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DEW POINT TESTERS

ASTM-D 1142-53

Now Manufactured in Two Models For LP Gas and Natural Gas. 0-1000 psi for LP Gas Vapor and Natural Gas. Model also available in 0-3000 psi. ASTM 11-42-53

PRECISION DETERMINATIONS: Bureau of mines tests show that with manipulation dew points can be duplicated to within 0.2° F.
ACCURACY: Averaging test measurements, the Bureau of Mines reported less than 0.2°F. Dew point temperature difference compared to known standards.
SAFETY: Hydrostatic tests show a maximum working pressure of 3,000 psi. Adjustable mirror allows for safe visual observation into the pressure body.

DEW POINT RECORDER

BUREAU OF MINES TYPE

RECORDS DEW POINT OF GASES UNDER PRESSURE

SUITABILITY: For use with gases under pressure; at pressures from atmospheric to 3,000 psi.
CONTINUOUS RECORD: of dew point gas.
RAPID RESPONSE: To changing dew point of gas.
RELIABLE RESULTS: Obtained to allow for the control of dew point of natural gas in long distance high-pressure transmission lines. This instrument records dew point of a continuous sample of natural gas at line pressure up to 3,000 psi.

REFINERY SUPPLY COMPANY

REFINERY SUPPLY COMPANY

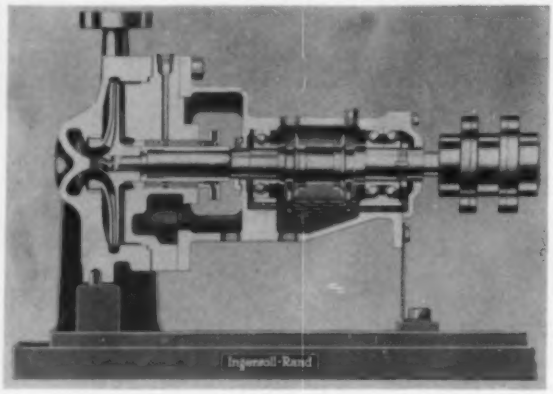
PRESSURE CONTROLS ARE PROFIT CONTROLS

Drilling for oil today requires proper pressure control to safeguard personnel and profits. Cameron is offering a new unified drilling control system which greatly simplifies blowout prevention and completion work. Every operation in controlling hazardous subterranean pressures encountered while drilling and completing a well is now possible at one convenient station. Pneumatic pressure from the rig eliminates the high pressure hydraulic system formerly used. The new Cameron Type "F" Blowout Preventer and Cameron Gate Valves on choke and kill manifolds are operated from one graphic panel on the rig floor.

All of this means more safety, greater convenience to the operator, and of course, better control of pressure and profits. Always COUNT ON CAMERON controls for drilling and production.

Cameron
IRON WORKS, Inc.
P. O. Box 1212 — Houston, Texas
Export Office: 7912 Empire State Bldg., New York City. In England: Cameron Iron Works Ltd., 76 Grosvenor St., London W. 1 England.

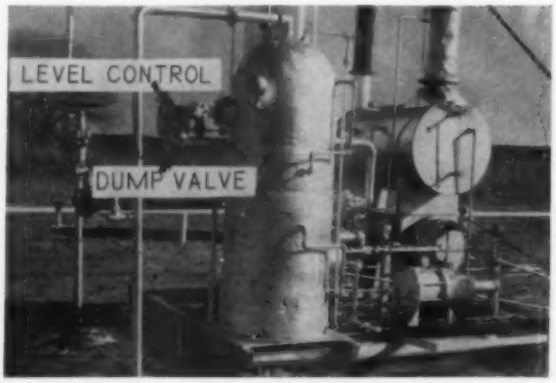
conforms to the pipe and is cemented in place. It cushions the pipe from shock and movement and so guards against future pipe breaks. **Write or call: Dresser Mfg. Div., one of the Dresser Industries, Inc., Bradford, Pa., for details on Model 360 pipe-repair clamp.**



Process pump for 300° F., 600 psi.

. . . offers capacities to 1,400 g.p.m. and heads to 650 ft. The SFLM pump is expected to prove valuable where water cooling of the stuffing box and bearings is unnecessary. The pump is a vertically split, single-stage, single-suction unit with an overhung impeller. Available discharge diameters go from 1 to 4 in.

The pump is designed so conversion to water-cooled operation is simple. All parts are interchangeable with the makers SFL water-cooled units. **Write or call: Ingersoll-Rand Co., Eleven Broadway, New York 4, for Form 7494.**



Dump valve for pressure vessels

. . . used in oil and gas production takes pressure to 6,000 psi. c.w.p. The valve can be actuated by a displacement type of liquid-level controller or other piloting devices capable of an air output of 6 to 30 psi. It can also be used for stop-cocking. Though designed for on-off service, it can be used for limited-throttling-range applications.

Available sizes are 1 and 2 in. with ratings of either 3,000 or 6,000 psi. c.w.p. Body is forged steel. Connections may be either screwed or socket welding type. The body may be an angle, globe, or special angle type adaptable to cold-weather service.

The actuator is reversible in the field. No extra parts are needed to convert from air-to-open to air-to-close, or vice versa. Diaphragm material is Buna N Nylon reinforced. At the top of the valve, an indicator shows inner-valve position. **Write or call: Black, Sivalls, & Bryson, Inc., 7500 East Twelfth Street, Kansas City 26, Mo., for Catalog 70-18.**

●

Fire hose unharmed by soaking

. . . in mud holes or when hung in an atmosphere heavy with acid fumes. When run over by a truck, it will not burst, the maker says. The Imperial

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Since the beginning of hydraulic fracturing, the petroleum industry's greatest volume dollar returns from any fracturing treatment has been due to the broader, more versatile application of *SANDOIL*.

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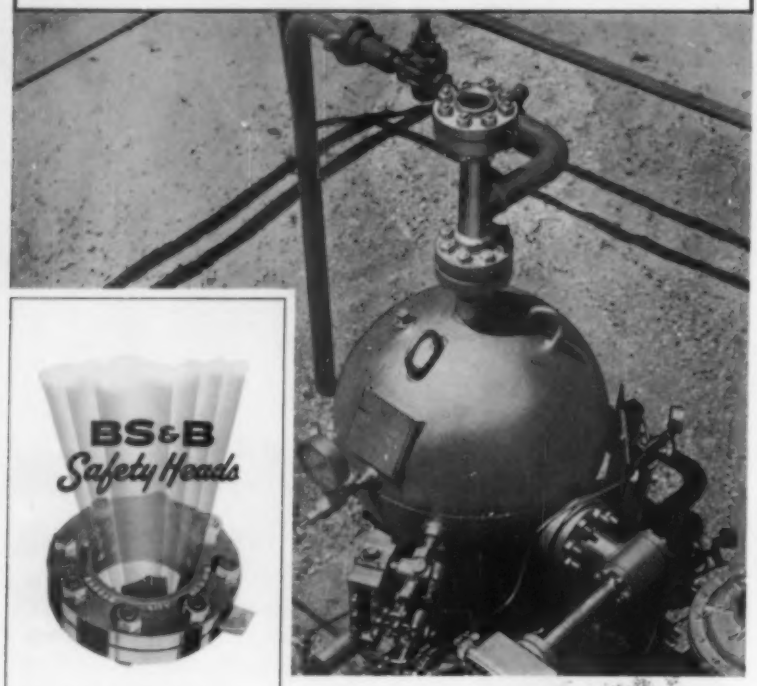

Make Sure YOUR Pressure Systems are Protected with BS&B Safety Heads

Pressure relief is an important consideration in the operation of pressure equipment. A sudden surge of overpressure could result in serious trouble . . . extensive damage to valuable equipment . . . serious injury to personnel or even loss of life.

Pressure systems may be protected with relief valves—being sized for normal overpressure conditions. However, there are times when relief valve capacity cannot handle overpressure buildups fast enough. Or valves may not function properly because of corrosion or "freeze-ups."

For standby relief, BS&B Safety Heads are the answer.

The BS&B Safety Head relieves undesirable pressure buildups instantly, rapidly reducing pressure within a system to a safe zone of operation.

BS&B sales engineers will be glad to inspect your pressure systems with you and help recommend proper pressure protection of your equipment. Call your local BS&B office. Or write to Central Sales Engineering in Kansas City.

BLACK, SIVALLS & BRYSON, INC.
Safety Head Division, Dept. 2-A2
7500 East 12th Street Kansas City 26, Missouri

hose is made with an all-Dacron jacket for service in refineries and petrochemical plants.

Hose ends are reinforced for 12 in. with a layer of hard-twisted cords. Available sizes range from 1 to 2½ in. **Write or call: B. F. Goodrich Industrial Products Co., Akron, Ohio, for details on Imperial hose.**

•

Jeweled escapement for chart drives

. . . has been developed and is now available with all 31-day Rockwell chart drives. Said to be the first jeweled movement used on general industrial timing devices, it promises increased accuracy for chart drives and takes little power for operation.

The escapement has seven jewels. Four are at the chart drive's balance-wheel pivots, one is at the balance-wheel roller pin, and two are at the verges of the pallet fork. **Write or call: Rockwell Mfg. Co., 400 North Lexington Avenue, Pittsburgh 8, for details on jeweled escapement for chart drives.**

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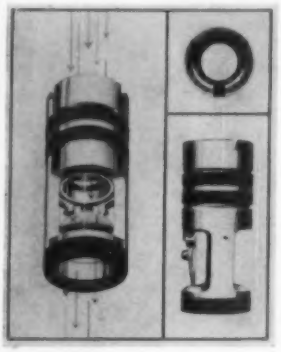

Drill-pipe float valve acts fast

. . . to give a tight seal against back pressure. Yet it opens fully during circulation and lets drilling fluid flow straight through the float without diversion.

To prevent wear from vibration, the full-flow float has vibration dampeners at key points—including a rubber shock absorber at the base of the cage. The maker reports that tests indicate the design innovations extend the operating life of the float two to three times that of conventional drill-pipe floats. Its fast opening and closing action prevents mud spillover on the rig floor and delays caused by waiting for a valve to open. **Write or call: Baker Oil Tools, Inc., 2274 Terminal Annex, Los Angeles 54, for details on Full-Flow drill pipe float.**

SHOWCASE . . .

New Literature

Heat-transfer equipment bulletin

. . . contains product information and selection data on storage water heaters and heat exchangers. The eight-page bulletin details such equipment as copper silicon and copper and cement-lined steel (horizontal and vertical) storage heaters, and two and four-pass convertors. Selection data consists of easy-to-use tables of hot-water fixture capacities, temperature-conversion factors, heating and storage capacities; standard dimensions, weights, and connections, plus line diagrams and typical applications of data. The bulletin also annotates catalog information available for specific types of heat-exchange equipment. **Write or call: Patterson-Kelley Co., Inc., East Stroudburg, Pa., for Bulletin 123-6.**

Stainless-steel valves

. . . including gate, globe, and swing-check types are outlined in a new available catalog. It details valve patterns in alloys that satisfy the requirements of most corrosive services. A 10-page section shows at a glance the degree of resistance of alloys to many corrosive media under varying conditions. **Write or call: Jenkins Brothers, Room 33, 100 Park Avenue, New York City 17, for Stainless-Steel Valves catalog.**

Special equipment for crawler tractors

. . . and for motor graders is illustrated in new 12-page Catalog MS-1189. The catalog pictures and explains attachments and accessories available to increase tractor and grader versatility and working capabilities and to add to operator comfort and safety under normal or unusual working conditions. **Write or call: Construction Machinery Div., Allis-Chalmers Mfg. Co., 1126 South Seventieth Street, Milwaukee 1, for Catalog MS-1189.**

Automatic-control systems

. . . is the title of a new, available, eight-page bulletin. It analyzes three phases of automatic-control system planning. Part one discusses the application, advantages, and features of "electronic-control" centers. Part two presents the three basic types of control—electric, electronic, and "electrionic"—their advantages and component structure. Part three deals with selecting the power-control system, and presents a guide of selection factors that might be considered on each installation. **Write or call: Barber-Colman Co., 1300 Rock Street, Rockford, Ill., for Bulletin F-8944.**

Snap-on-and-off backhoe

. . . called Hopto is described in a new, comprehensive, eight-page folder. The folder shows with photographic illustrations how easily the backhoe can be attached in 30 seconds to either a crawler or rubber-tire tractor. Pictures of Hopto at work on a variety of jobs show its versatility. **Write or call: Badger Div., Warner & Swasey Co., Winona, Minn., for Hopto Backhoe folder.**

Tray-type deaerating heaters

. . . are detailed in new 12-page Bulletin WC-106A. It covers a variety of subjects including principles of deaeration, tray-heater operation, standard heater design and applications, accessory equipment, and design and fabrication of tray-utility heaters. A section on design features discusses load variations, installation, metallurgy, and construction of trays and vent condensers. The bulletin includes cutaway drawings of typical tray and

is the SPECIALTY of this
WISCONSIN-POWERED Unit

Unique in design and construction, this pumping unit, developed after extended research and experimentation by Harley Sales Company and co-operating manufacturers provides a practical and efficient means for salt water disposal . . . either in general transfer operations or to disposal wells. Among its refinements, for the first time, a pump of this kind has been equipped with "fluorogreen" valves for high resistance to salt-water corrosion and wear.

A Model AEH Wisconsin Single Cylinder Heavy-Duty Air-Cooled Engine drives the specially designed F. E. Meyers & Bro. Pump. Cap., 10 BPH at 400 psi.

This equipment meets a growing need for an economical and practical means to prevent salt-water pollution of streams and surface pollution of land acreage. This is insurance against possible expensive litigation and government citations. Many of these installations are now in use, operating around the clock.

This is a typical oil field assignment for Wisconsin Heavy-Duty Air-Cooled Engines . . . designed and built to "take it" under continuous loads, day after day, month after month . . . in any location, any climate. Rugged, high-quality construction in all details, combined with load-lugging, high torque performance, and self-sustaining operating dependability, are features that keep the equipment going and hold down maintenance costs.

You can't do better than to specify "Wisconsin Power" for your oil field utility units.

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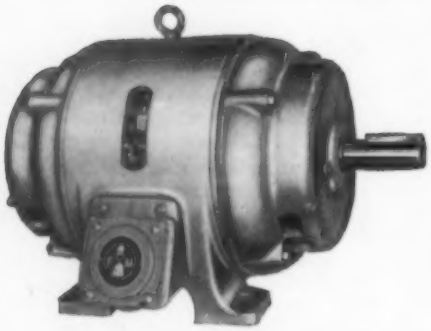
Oil Field Distributors for Wisconsin Engines and all types of Utility Engines

Low-cost jackpower starts with quality!

Fairbanks-Morse "ZC" Engines

The most dependable, most thoroughly proven engine available today for pumping service. The rugged, simple Fairbanks-Morse "ZC" is known the world over for its rock-bottom economy—its ease of starting in coldest weather—its efficiency on both gas and gasoline, with full-power switch-over to either. Clutch and sheave mount on either end of crankshaft for maximum adaptability. Six "ZC" sizes range from 3 to 30 horsepower.

Fairbanks-Morse Guarded Dripproof Motors



A completely guarded squirrel-cage induction motor with exclusive design for oil field service. Heavy-duty protected frame prevents entry of dripping liquids, flying chips or falling particles. Available with high torque, normal starting current—high slip, high starting torque—or general purpose normal torque. Ratings from ½ to 40 hp., 3600 to 600 rpm.

See your local supply store or write Fairbanks, Morse & Co., Oil Field Division, 1713 N. Market St., Dallas 2, Texas. Ask for new F-M Oil Field Equipment Bulletin.

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DIESEL, DUAL FUEL AND GASOLINE ENGINES • ELECTRIC MOTORS • PUMPS • COMPRESSORS
GENERATORS • SCALES • MAGNETOS • HOME WATER SYSTEMS

utility-tray heaters. **Write or call: Graver Water Conditioning Co., 216 West Fourteenth Street, New York City 11, for Bulletin WC-106A.**

Instrument-training program

. . . of a company's school for instrument engineers and technicians is described in a new bulletin. It lists the staff and describes five major training courses offered. A general instrument course, a telemetering service course, an advanced telemetering course, and courses on pneumatic instruments and self-balancing bridges and potentiometers are offered regularly, in addition to special courses as need occurs. The bulletin includes instructions for admission applications. **Write or call: Bristol Co., Waterbury 20, Conn., for Instrument-Training Program bulletin.**

Motor pump prevents gas binding

. . . and loss of prime with a special impeller, as described in new eight-page Bulletin 70021. The new centrifugal pump, called Vapor-Flo, is illustrated with pictures and drawings. Another eight-page bulletin, 70022, offers 20 sizes of motor pumps that are available off-the-shelf. This bulletin contains drawings that pinpoint features of the motor pumps' impellers, seals, casings, and the electric motors that drive them. It includes selection charts, friction tables, dimensions, and a typical pump work sheet. **Write or call: Ingersoll-Rand Co., 11 Broadway, New York City, for Bulletins 70021 and 70022.**

175-page apparatus, instrument

. . . catalog describes more than 450 different pieces of equipment. The catalog, which contains an extensive line of petroleum-testing equipment, should be useful in both laboratories and plants. It has embossed leatherette covers with multiring binders. **Write or call: Labline, Inc., 3070 West Grand Avenue, Chicago 22, for 1959 Apparatus and Instrument catalog.**

Temperature-indicator monitor

. . . that's electronic is depicted in new four-page Bulletin MSP-155. The bulletin gives operational features, specification data, and discusses switching, amplifying, off-normal alarms, power supply, and basic-design parameters. **Write or call: Kybernetes Div., Hagan Chemicals & Controls, Inc., P. O. Box 1346, Pittsburgh 30, for Bulletin MSP-155.**

Birdwell, Inc. is purchased

... by Seismograph Service Corp., Tulsa, in order to increase the range of logging and other wire-line well services available to clients of both firms. The announcement was made jointly by G. H. Westby and James M. Bird, presidents of SSC and Birdwell, respectively.

J. M. Bird

S. M. Flynn

R. D. Clarke

Bird, who founded the company 13 years ago, was named vice president of SSC in charge of all well-logging activities. He and other staff members, including Stanley M. Flynn and Robert D. Clarke, will move to Tulsa. Flynn is vice president in charge of field operations for Birdwell, and Clarke is assistant to the president.

Under terms of the purchase, Birdwell's personnel and facilities will function as a division of SSC. Birdwell has 139 employes and 27 field trucks operating out of 11 field stations.

Bird emphasized that Birdwell's headquarters, located in Bradford, Pa., along with other Birdwell stations, will be maintained under the consolidation.

Harman Holcomb, Jr. transfers

... from Brookhaven to Laurel, Miss., where he will continue to work as a field representative for U. S. Steel's Oil Well Supply Division. The announcement came from M. F. Jones, the division's Gulf Coast area manager.

Holcomb was employed by Oilwell in 1952 at Snyder, Tex., and was transferred in 1953 to Denver City, Tex., where he was appointed field representative two years later. In 1957 he was moved to Beaumont, Tex., and the following year to Brookhaven.

George H. Roman joins

... Vinson Supply Co. in Tulsa as a salesman for oil-country tubular goods, according to Bailie W. Vinson, president. Roman formerly was Tulsa representative for Hydril Co. of Los Angeles.

Johnson Testers slates

... a reorganization of field offices into two divisions, each containing three areas, reports D. C. McCann, president.

B. R. Dixon, former assistant to McCann, will be division manager of the northern district which contains the California, Rocky Mountain, and Kansas-North Texas-Oklahoma areas. Dixon will headquarter in Denver.

B. R. Dixon

G. D. Duke

G. D. Duke, former assistant manager of field operations, will be the southern division manager and will locate in Houston. The southern district takes in the Louisiana-Mississippi, Texas Gulf Coast, and West Texas areas.

Dixon joined the company in 1953 as a sales engineer. He was promoted to assistant sales manager in 1957 and to presidential assistant last summer.

Duke started with Johnson as a tester 13 years ago. He became manager of the Tyler, Tex. district, the Houston district, and then the Kansas-Oklahoma area. Duke was promoted to assistant manager of field operations in August, 1958.

Bethlehem Supply promotes

... J. V. Spalding to general sales manager. He will be located in Tulsa. At the same time Bethlehem Steel Co.'s Supply Division announced that H. L. Hawkinson, Jr. had been appointed Gulf Coast division manager; R. O. Branyon, sales manager of Rolo products,; and W. J. Brady, division sales projects manager, all to be located in Houston.

J. V. Spalding

H. L. Hawkinson

Spalding was employed by Bethlehem in 1939. He held positions of sales engineer at Salem, Ill., Houston, and Tulsa. In 1950 Spalding returned to Houston as division manager of engineering sales for the Gulf Coast region. Two years later he was promoted to Gulf Coast division sales manager.

R. O. Branyon

W. J. Brady

Hawkinson was employed by Bethlehem in 1940, and served at Tulsa, Odessa, Tex., and Houston. His most recent post was manager of machinery sales for the Gulf Coast division.

Branyon has been associated with supply for 26 years. Prior to his new assignment, he was division machinery sales representative in Houston.

Brady, a Bethlehem employe for 19 years, has been resident sales manager in Houston for the past six years. He has been associated with oil-field supply for more than 29 years.

Cardwell Mfg. Co. names

... Don Rhoads a special sales representative for Kansas and parts of

NEW SUBDIVISION OFFICE of Welex, Inc. is shown on the right. The masonry structure, located in Great Bend, Kans., houses Welex's log-drafting section, division engineer, division mechanic, and contains about 2,500 sq. ft. of floor space. It's under the direction of W. B. Clark, assistant division manager. The building on the left is Welex's district office.

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Service"

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MARINE SERVICE
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MAgnolia 6824
New Orleans 12, Louisiana

Oklahoma, where he will concentrate on Cardwell's drilling and servicing equipment, mud pumps, pipe, and supply accounts. He will headquarter at the company's main office in Wichita, Kans.

Rhoads' 24-year oil-industry background includes service with Gulf Oil Corp., Jones & Laughlin Steel Corp., Bethlehem Steel Corp., and Buda Engine Co.

M. C. Niblack is promoted

. . . to sales department manager of Iverson Supply Co., announces S. J. Iverson, president of the Tulsa firm. The post was formerly held by T. D. Collins, who resigned due to ill health. Niblack has been with the company for more than 12 years.

M. C. Niblack

Other personnel changes at Iverson include the transfer of John R. Bryant to city sales in Dallas from store manager, Snyder, Tex.; transfer of Paul D. Iverson, Jr. to city sales in Midland, Tex., from field sales, Kermit, Tex.; and promotion of Peter C. Iverson to store manager in Snyder from field sales in the same location.

Aero Design announces

. . . sales management personnel changes.

E. B. Charles

E. B. Charles, former commercial sales manager, was appointed general sales manager. Robert Geis, formerly of Beech Aircraft Corp., was named domestic sales manager in which position he will develop the company's commercial domestic business through the distributor sales organization in the United States.

Robert Geis

Tom Sim

Tom Sim was named Aero Design & Engineering Co.'s export sales manager. He was with Air Carrier Service Corp. Sim's job will be in developing world-wide export sales activities.

In addition, the company named Clarence Morgan the new director of sales training and Jack Rector public-relations manager.

Baroid appoints

. . . a district superintendent and two sales representatives. Billy J. Hurst, former drilling-mud service supervisor, is the new district superintendent with headquarters at Morgan City, La. He has been with Baroid Division of National Lead Co. since 1950.

V. S. Hefley, who was replaced by Hurst at Morgan City, was named sales representative with headquarters at New Orleans. Hafley has been with the company for more than 13 years. R. C. Briscoe, former store manager in Baroid's West Texas area, was appointed sales representative with headquarters at Abilene, Tex.

Tretolite adds engineers

. . . to its staff of field-service personnel. Robert F. Owen, former employe of Core Laboratories, Inc., has joined the company's South Louisiana district and is located in New Orleans. Wallace Wayne Geddes, previously employed by Quinntanna Petroleum Co., Refugio, Tex., has been assigned to the Houston district and is located at Pasadena, Tex., as a representative. Tretolite Co. is a division of Petrolite Corp.

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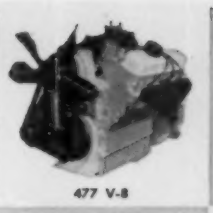

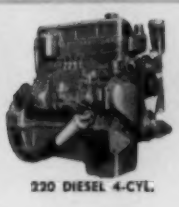

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Whatever your application, consider the many advantages you get with a Ford Industrial Engine.

Completely modern throughout, all Ford engines have Short Stroke design for increased operating economy . . . overhead-valve construction for quick, easy servicing . . . and provide more horsepower per pound of engine weight than ever before possible. To cut costs on *big* jobs, Ford offers 3 new Super Heavy Duty V-8's with totally new lubrication-, cooling-, and fuel-systems.

Ford Industrial Engines range from 134 to 534 cubic inches . . . including two Diesels. All are available as engine assemblies or power units, and can be fitted with Ford-approved attachments such as SAE housings, torque converters, transmissions and other equipment for special operating needs.

What's more, Ford users enjoy a minimum of downtime because there's always a Ford Dealer nearby with a complete stock of the more commonly purchased replacement parts. Yours at low Ford prices.

Get the *right* power for your application. Check Ford's full line of 4-, 6-, and V-8-cylinder engines soon.

INDUSTRIAL ENGINE DEPARTMENT • FORD Division of FORD MOTOR COMPANY
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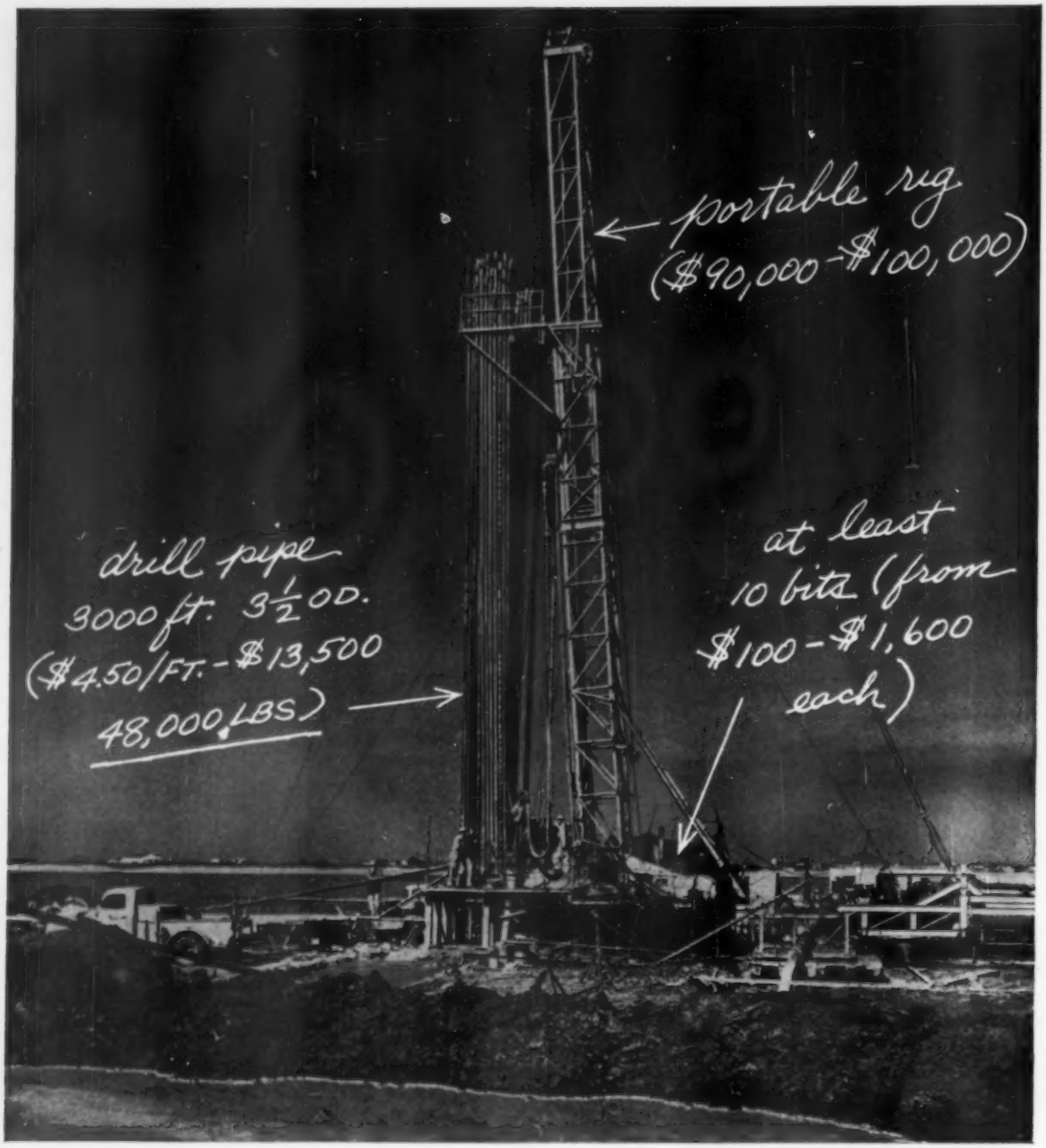

When you spend $90,000 for a drilling rig you've got to use the best rope available

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Costs up, prices down, completions off; drillers have bad year in 1958

DRILLING CONTRACTORS should do better in 1959 than in 1958. But this isn't saying much considering last year was the worst in a decade as far as the drilling business is concerned.

During 1958 contractors saw another year of rising costs and dropping contract prices—with them in the middle of the squeeze.

Here's a rundown:

...Active rotary rigs dropped to an average of 2,086 a month—the lowest since 1947 and a 20.4% drop from the prior 12 months.

...Total rotary-drilling costs reached 208% of the 1941 average. That was a 2% increase over 1957.

...Contract drilling prices dropped to a low of 88% of the 1941 figures—a 2% decline from the previous year.

...The number of wells drilled was estimated at 48,312, off 10% from the year before.

These are among highlights of the annual survey by the American Association of Oilwell Drilling Contractors.

The report says the price per foot paid the drilling contractor last year dropped to $4.50—the lowest figure in 15 years.

On a little brighter side are figures showing increased efficiency and a higher percentage of wells drilled by contractors. Battling the economic pinch, contractors stepped up efficiency by shaving average drilling time to 52% of the 1941 time. It was reported at 54% in 1957. The percentage of wells drilled by contractors increased from 93% in 1957 to 95% during 1958.

Bright spot . . . The report says 1959 should be a better year for drillers.

An excellent chance for at least a nominal increase over 1958 activity is seen "with a more sensible control of imports and an equitable distribution of capital funds to domestic needs."

Trends in U. S. Drilling

Year	Average Depth (Per Well)	Average Contract Cost ($ Per Ft.)	Average Total Cost ($ Per Ft.)
1935	2,760	5.00	8.00
1936	2,797	4.75	7.75
1937	2,985	4.50	7.50
1938	3,110	4.25	7.50
1939	3,053	4.25	7.50
1940	3,088	4.00	7.50
1941	3,056	4.25	7.25
1942	3,088	4.00	7.50
1943	3,046	4.50	8.00
1944	3,272	4.75	8.25
1945	3,489	5.00	9.00
1946	3,345	5.00	9.50
1947	3,404	5.00	10.25
1948	3,463	4.75	10.75
1949	3,558	4.75	10.75
1950	3,689	5.00	11.00
1951	3,869	5.50	11.50
1952	4,060	5.85	12.00
1953	4,016	5.60	12.50
1954	4,025	5.10	12.75
1955	4,044	4.90	13.25
1956	4,022	4.75	13.50
1957	4,103	4.60	13.60
1958*	4,031	4.50	13.25

*Estimated.

Drillers' Plight: From Bad to Worse

(All figures in per cent)
(1941 = 100)

	1945	1950	1951	1952	1953	1954	1955	1956	1957	1958
Labor Costs	140	190	196	197	198	200	202	204	208	**208**
Equipment Costs	110	175	180	183	188	190	195	200	205	**208**
Miscellaneous Costs	120	175	181	185	188	191	194	199	204	**206**
Total Rotary Drilling Costs	122	180	186	189	192	194	197	201	206	**208**
Drilling Prices (Footage Basis)*	115	100	103	103	102	99	96	93	90	**88**
Avg. Drilling Time (Days)	95	65	60	59	58	56	56	54	54	**52**

*For drilling in same or similar fields to comparable depths.

Who's getting the drilling contracts

Win Hawkins Drilling Co., Houston, has a new drilling job under way in the Boutte area, southwest of New Orleans, in St. Charles Parish, Louisiana Gulf Coast. It is for Riverside Oil Co., of New Orleans, at 1 Rathborne, in 17-14s-21e. A 10,800-ft. test is planned.

Davis & Bates is the contracting firm on a 7,800-ft. test Glen A. Martin and Texas Eastern Transmission Co. are starting 5 miles southeast of Kenedy, in southern Karnes County, in Texas' central coastal region. Location is on the operators' Radford lease, in the Carlos Martinez Survey.

Sunnyland Drilling Co., Rayne, La., is on a new contract operation at a wildcat location 5 miles northwest of Edgerly, in northern Calcasieu Parish, southwestern Louisiana. It is for S. B. Laub and associates at 1 Industrial, in 30-8s-11w. Location is more than 4 miles from nearest production, being southwest of DeQuincy field.

Chiles Drilling Co., Alice, Tex., has a rig running on a wildcat location 4 miles north of Refugio in Refugio County, South Texas. Katz Oil Co., of San Antonio, the operator, has permit for a 7,500-ft. test with Frio sands as its objective. Location, at 1 Hynes, in the John Malone Survey, is about 1½ miles northwest of production in the old Refugio fields area.

Abney & Sons Drilling Co., Oil City, La., is drilling on a newly started Cotton Valley test south of Magnolia field in eastern Columbia County, South Arkansas. It is a contract job for Horizon Oil Co., Inc., El Dorado, Ark., at 1 McGowan, in 3-17s-19w. Contract is for 6,000 ft.

John B. Stephens Drilling Co., Mount Pleasant, Tex., has a rig running on a wildcat location 10 miles southwest of Gladewater, in eastern Smith County, East Texas. Drilling is for A. O. Phillips, Amis & Starr, of Dallas. Plans call for a Pettet, or 8,500-ft. test. Location is at 1 Edmund Warren estate, in the John Slayden Survey. This is about a mile from production in Chapel Hill field.

L. H. Scott Drilling Co. is contractor on a 6,000-ft. test Colmarran Oil Products Co., Inc., is starting in Clark County, Nevada. Location is 12 miles southwest of Las Vegas, on the Arden structure.

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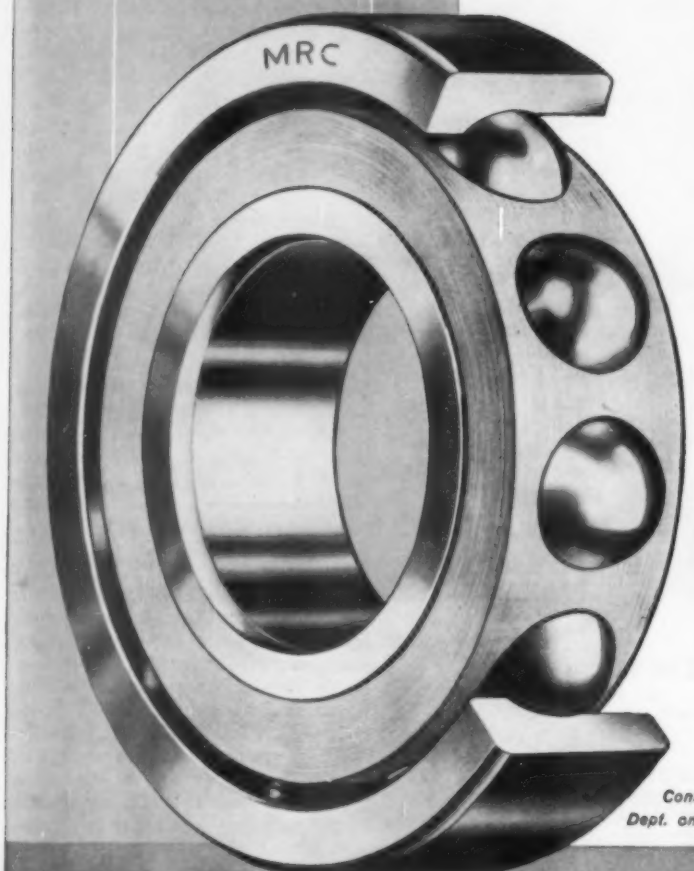
Therefore, to obtain the advantages of "Star Quality" performance use M-R-C 7000-P bearings for your heavy duty requirements.



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TWO RECENT TRENTON DISCOVERIES in southern Michigan counties have established a new northwest-southeast trend in that area. Operators look for a brisk wildcat campaign based on the twin strikes.

Southern Michigan wildcatters play it by ear

BY FRANK J. GARDNER

ABOUT HALFWAY between Detroit and Chicago, a hot new oil play is shaping up for 1959. In southern Michigan's Hillsdale, Jackson, and Calhoun counties, two recent Trenton-Ordovician oil strikes have outlined a 12-mile golden lane, and the leasing spree is on.

An accidental find . . . It all began in January 1957, when, after a year and a half of spasmodic drilling, C. A. Perry completed his 1 Houseknecht (Scipio Township, 10-5s-3w) as the discovery well of Scipio field in northwestern Hillsdale County (OGJ, Sept. 1, 1958, p. 214). This was a nontechnical location between two gravity highs. It was spudded in May 1955, and on final completion was rated good for 800 bbl. daily from the Trenton-Black River at 3,576 ft. after drilling to 3,900 ft. total depth. Official potential was 150 bbl. daily on restricted flow.

The Scipio strike attracted little attention at the time of completion, but in September 1957, Aurora Gasoline Co. and McClure Oil Co. had a blowout at the 1 Stevens, fourth well in the field. The well was controlled after flowing an estimated 2,400 bbl. daily, and Scipio hit the headlines all over the oil country. As of the first of this year, the field had 25 producers in the Trenton.

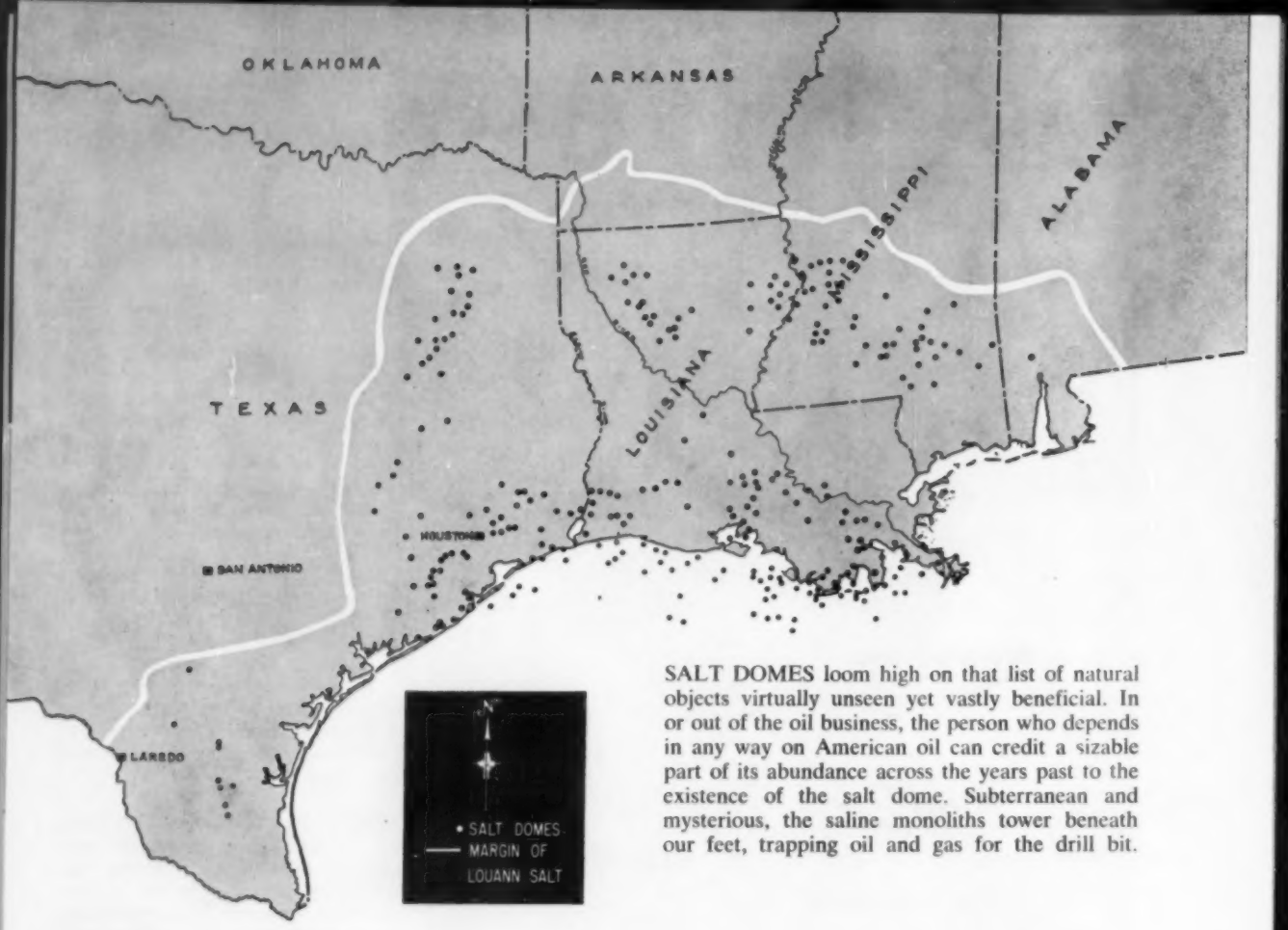
Plus two on trend . . . In late December 1958, a wildcat 12 miles northwest of Scipio in southeastern Calhoun County (Albion Township, 23-3s-4w) was finished for 296 bbl. of oil per day on 26/64-in. choke. This was Tom Mask and McClure Oil Co. 1 Rosenau. Again, the Trenton-Black River dolomite had paid off handsomely in southern Michigan. Producing depth for the Rosenau strike was 4,090 ft. Carter Oil Co. now is drilling a north offset to the discovery.

Now comes news of yet another Trenton hit about halfway between Scipio and the Rosenau well, to anchor the trend in southwestern Jackson County. Turner Petroleum Corp. has potentialed its 1 Blair wildcat (Pulaski Township, 20-4s-3w) for 265 bbl. of oil in 22 hours. Choke size was 10/64-in. Pay level here is 3,820-32 ft.

These three Trenton discoveries have set off a leasing binge all over southern Michigan. The play involves 12 counties and spills over into northern Ohio.

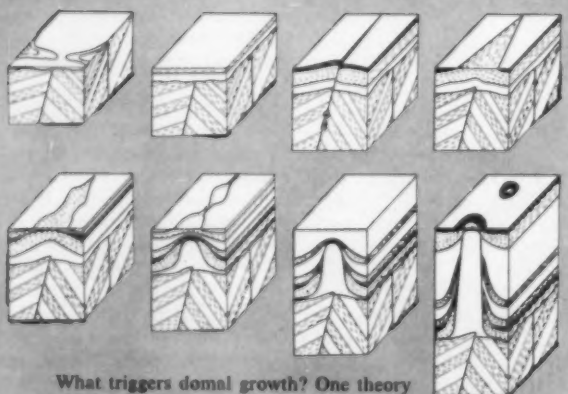
Means drilling in the dark . . . These are hit-and-miss operations. For production depends on spotting the dolomitized zones in the pay section. Structure apparently is secondary and has little influence on the oil accumulation. "We're working in the dark," say southern Michigan geologists. The productive pay is a secondary dolomite, tightly folded and fractured. At Scipio, the producing wells are structurally low to the dry outpost wells that have been drilled. Operators in the area are hopeful that with the drilling of more wells and an expanded emphasis on coring, a better understanding of the oil entrapment may be reached. Meanwhile, we can expect a rash of free-for-all wildcatting up and down this 12-mile trend in 1959.

Here, in southern Michigan, is an example of what the geologist faces in his frustrating hunt for stratigraphic traps. Here also is an illustration of an ill-explored province brought to life by an accidental discovery. The Trenton-Black River section, prior to the Scipio strike, was practically ignored by oil finders in Michigan. The earlier discoveries in that formation east of the present play (see map) should have alerted operators in the state to the possibilities of the formation as an oil source. But 2 years elapsed between the strikes at Northville (Wayne County) and Scipio. Now, the Trenton appears to be the best clue to new fields of importance in the Wolverine state.



SALT DOMES loom high on that list of natural objects virtually unseen yet vastly beneficial. In or out of the oil business, the person who depends in any way on American oil can credit a sizable part of its abundance across the years past to the existence of the salt dome. Subterranean and mysterious, the saline monoliths tower beneath our feet, trapping oil and gas for the drill bit.

Salt domes: favorite home for oil



What triggers domal growth? One theory (l to r, top to bottom above) holds that faulting and folding of strata *underlying* mother salt causes salt domes to start rising, due to static load differential set up in sediments deposited on top of salt.

OIL MEN have responded to nature's salt-dome cue with impressive results. Today along the Gulf of Mexico's crescent coast, oil and gas are drawn from reservoirs abutting 278 known domes or salt structures, on and off shore. Quite simply, the Gulf Coast has much of its oil because it has salt domes. It has, in fact, probably a greater number of intensely-studied domes than in any other area. Why? How do they trap oil and gas? Do they still grow? Are domes in themselves usable?

To realize the importance of petroleum reserves associated with salt domes, consider just those domes along the Texas coast which, by the end of 1956, had each produced over 50 million barrels of oil (see chart). There are 17 such domes situated in Chambers, Liberty, Montgomery, Harris, Brazoria, Austin, Hardin, Jefferson, and Fort Bend counties.

Twelve of the seventeen have produced over 90 million barrels, and their total production at the start of last year stood at more than 2,200 mil-

lion. While five of these domes force their tops within less than 1,000 ft. of the surface, there are seven whose caps have yet to be touched by the drill bit. Of course, others are known besides these. There are 278 principal domes ranging from the southern tip of Texas to just across the Alabama border, and many more have been detected through geophysical surveying.

What actually is a salt dome? Well, visualize a mass that makes you feel you're the size of an ant in a world scaled to giants. Shaped rather like the buttes and mesas across the Southwest, the salt dome is many, many times larger and is the blue-gray color of an ice cube. Admittedly, it is almost impossible to imagine a mass that is nearly 8 miles high and 1 to 8 miles in diameter. More fantastic, it's all underground. One large dome on the Continental Shelf many miles offshore has a size at 13,000 ft. down, of 7.2 miles length and 4.5 miles width.

Domes vary not just in size, but in shape as well. Small domes may contain a modest 10 cu. miles of 90 to 95% pure salt. The big ones boast as much as 75 cu. miles or more. As for the 5 to 10% of impurities, most of this is anhydrite. These impurities are often left near the top of the dome as water dissolves the salt. Deposited out first atop the salt is an anhydrite sand that becomes hardened to rock and is termed massive anhydrite. At lesser depths this material takes up water and becomes gypsum. Above this forms limestone caprock which, on some domes, contains large deposits of sulfur.

How Domes Originate

Salt domes form as a result of the ever-growing weight of sedimentary deposits on deep-seated, ancient salt-bed deposits. From among the many theories, Gulf Coast area geologists generally agree that (1) a mother salt bed is the source for Gulf Coast domes; (2) some trigger action started the salt flowing; (3) after the triggering the salt flows due to differences in static load of sediments around and over the dome; (4) as the rising dome pushes up through the overlaying beds it usually becomes somewhat rounded in cross-section, and (5) flowage goes on simultaneously as new sedimentary beds are being laid down.

Some domes on the continental shelf are growing at the rate of 1 ft. every 100 years. Educated estimates hold that salt flows upward through some of the conduits at a rate of 1 cu. mile in 50 to 75 thousand years. The mother salt for the domes beneath Texas, Louisiana, Mississippi, Alabama, northwestern Florida, and the adjacent Gulf is called the Louann salt, and is thought to be a more or less continuous bed, deposited in a great salt basin 150 to 200 million years ago.

The great weight of later-deposited sediments squeezed up the domes from this salt bed. Other extensive salt horizons are known in this area and may have contributed to the domes.

Ocean water contains about 3.5% salt. As it evaporates in basins only slightly connected with the main water body, mineral content concentrates. First to crystallize is calcium carbonate, or limestone. Then calcium sulfate, or anhydrite. Third, halite or rock salt, and last to crystallize are several minerals such as those from which potash fertilizer is made. This was the general evaporation cycle when the Louann salt was deposited. Its thickness is not known except at the basin's margin. But it may have been as thick as 5,000 ft. over much of the basin before it started oozing up domes.

World Dome Distribution

Of the areas underlain by rock salt in the U. S., only two are known to contain salt domes. One is the Gulf Coast area and the other is the Paradox basin area in southeastern Utah and southwestern Colorado. For that location, the character of the domes and their development history isn't too well known.

As for the Gulf Coast, much of our present data on domes results from the thousands of wells drilled around and into the domes in prospecting for oil, gas, and sulfur. Additionally, several salt mines are currently producing the salt itself from the top of some of these domes. Prospecting in other salt dome areas of the world, such as Germany and Denmark, is limited compared to that along the Gulf Coast.

Domes known today have been detected by various methods. Initially, through surface geology, they were identified by mounds (like the one at High Island near Houston), lakes, paraffin beds, and, in one case, rock salt. When the first wells were drilled, subsurface geology proved an important tool. In the late '20s the torsion balance and seismograph were added as finding tools. The torsion balance, originally a pendulum, has found salt domes because rock salt weighs less per cubic foot than hard rocks. The seismograph found salt due to the difference in the velocity of sound passing through salt and rocks.

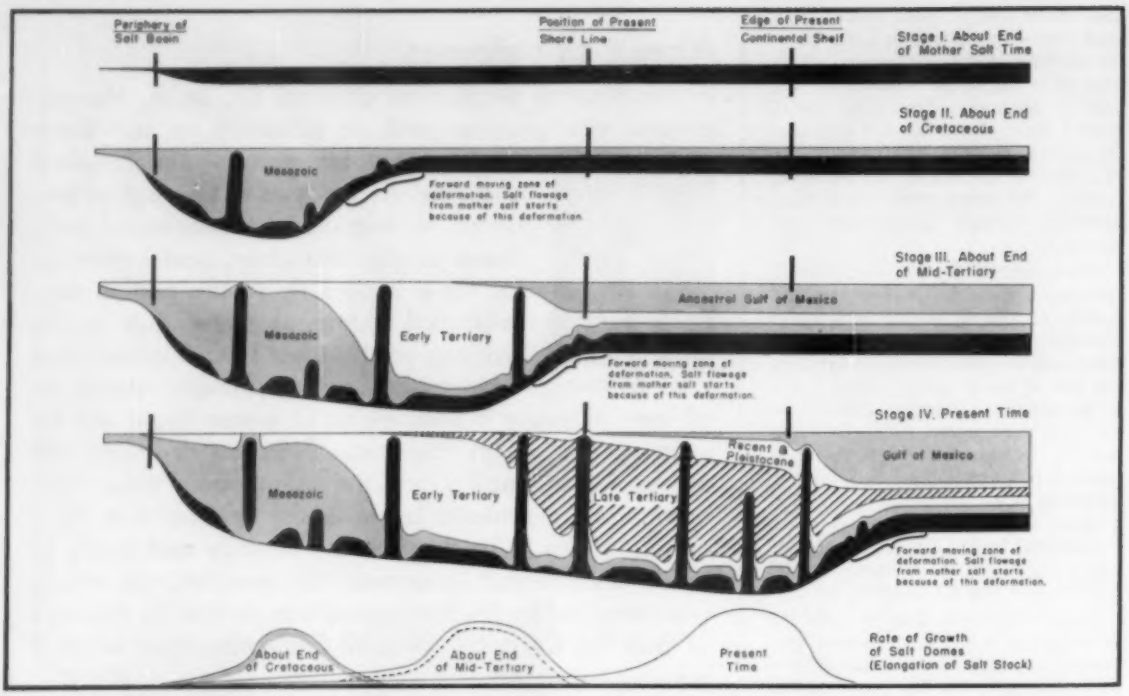
Underground Water Effect

Underground water dissolves salt domes. Most people are aware of how water moving underground through porous formations has created such cavities as Mammoth Cave and Carlsbad Caverns. In the Gulf Coast area the formations slope deeper and deeper as they near the Gulf. The beds exposed at Dallas, for instance, are

About salt domes . . .

In the Houston production division, Dr. M. A. Hanna, division stratigrapher and an authority on salt-dome geology, has for many years compiled and published masses of geological evidence in formulating theories of salt-dome origin, character, and behavior. Rarely is it possible to tap such a concentrated source of knowledge as his writings on a subject so specialized and labyrinthian, yet of primary interest to oil men of every breed, many of whom might not be working except for capricious Nature's dramatic salt domes. What, really, can one learn about these mysterious salt mountains beneath the ground that have accounted for so much of our oil already and testify to future discoveries? To answer this question, this article was compiled by Dr. Hanna and was written by the staff of Gulf Oil Corp. for the Gulf Oilmanac, from which it is being reprinted.

DR. HANNA


Periphery of Salt Basin
Position of Present Shore Line
Edge of Present Continental Shelf
Stage I. About End of Mother Salt Time
Stage II. About End of Cretaceous
Mesozoic
Forward moving zone of deformation. Salt flowage from mother salt starts because of this deformation.
Stage III. About End of Mid-Tertiary
Ancestral Gulf of Mexico
Mesozoic
Early Tertiary
Forward moving zone of deformation. Salt flowage from mother salt starts because of this deformation.
Stage IV. Present Time
Recent & Pleistocene
Gulf of Mexico
Mesozoic
Early Tertiary
Late Tertiary
Forward moving zone of deformation. Salt flowage from mother salt starts because of this deformation.
About End of Cretaceous
About End of Mid-Tertiary
Present Time
Rate of Growth of Salt Domes (Elongation of Salt Stock)

RISE OF GULF COAST DOMES through geologic time shows in this cross-sectional account (top to bottom) of four stages in deposition of sediments atop mother salt bed by rivers, streams, and prehistoric seas. Domes were supposedly triggered by difference in static load of sediments at, and ahead of, area of deposition.

COASTAL TEXAS DOMES WITH CUMULATIVE PRODUCTION OVER 50,000,000 BARRELS

Millions of barrels
0
50
100
150
200
250
300
350
Anahuac, Chambers Co. 145,919,000 DEEP, SALT NOT REACHED
Barbers Hill, Liberty Co. 108,089,000 TOP OF SALT, 1,000 FEET
Conroe, Montgomery Co. 374,544,000 DEEP, SALT NOT REACHED
Goose Creek, Harris Co. 101,992,000 DEEP, SALT NOT REACHED
Hastings, Brazoria Co. 291,195,000 DEEP, SALT NOT REACHED
Hull, Liberty Co. 146,682,000 TOP OF SALT, 595 FEET
Humble, Harris Co. 141,558,000 TOP OF SALT, 1,200 FEET
Manvel, Brazoria Co. 58,151,000 DEEP, SALT NOT REACHED
Pierce Junction, Harris Co. 77,233,000 TOP OF SALT, 930 FEET
Raccoon Bend, Austin Co. 61,983,000 TOP OF SALT, 11,365 FEET
Sour Lake, Hardin Co. 100,442,000 TOP OF SALT, 719 FEET
Spindletop, Jefferson Co. 135,305,000 TOP OF SALT, 1,200 FEET
Sugarland, Ft. Bend Co. 54,176,000 TOP OF SALT, 4,280 FEET
Thompson, Ft. Bend Co. 229,967,000 TOP OF SALT, 9,314 FEET
Tomball, Harris Co. 60,803,000 DEEP, SALT NOT REACHED
Webster, Harris Co. 237,079,000 DEEP, SALT NOT REACHED
West Columbia, Brazoria Co. 128,260,000 TOP OF SALT, 750 FEET
TOTAL 2,453,378,000*
* through Dec. 31, 1958

SALT AND OIL make an alluring combination as indicated by these 17 Texas domes (above) with present production over 50 million barrels.

probably submerged 30,000 ft. at the coast line.

Water in these sloping beds is under artesian pressure, and will flow upward around a salt dome if an escape route is available. The results of such upward migration of water is visible in the shallow lakes that mark the tops of some domes. As the salt is dissolved, cavities are formed atop a dome, and eventually its roof of sediment and caprock collapses into these cavities. This weight compresses the anhydrite sands atop the salt into rock anhydrite, a substance that on shallow domes not below 2,000 ft. often changes to gypsum as underground water reaches it.

As the cycle of dissolving, collapse, and formation of rock anhydrite reoccurs, thick sections form. If gypsum caprock has formed, it may continue to change into limestone caprock, and both these substances develop cavities, thanks to the cyclical dissolving of salt and collapse of caprock. On some domes—Spindletop, for instance—this cavernous limestone caprock contains the oil. Or there may be quite large deposits of sulfur.

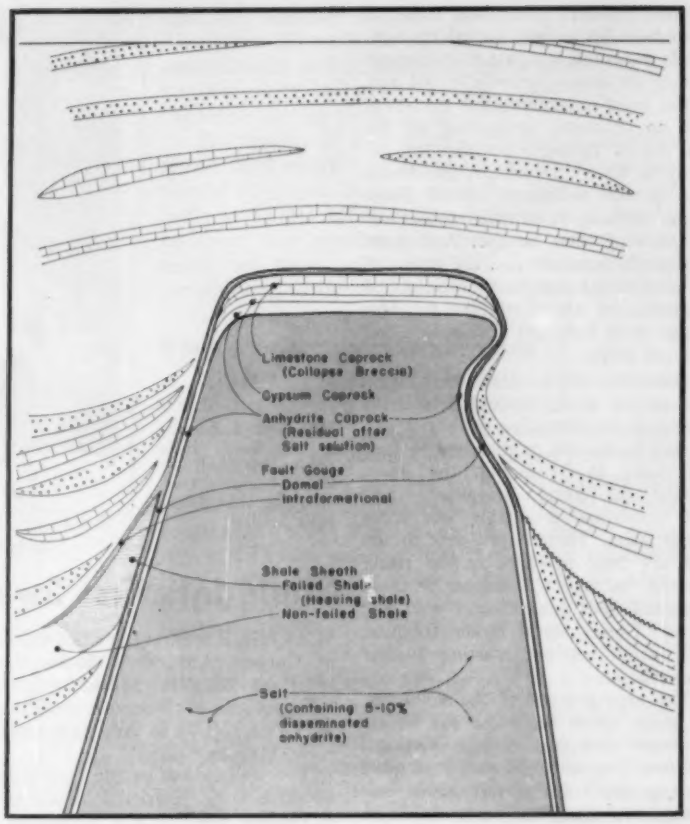
When the flow of water runs upward along the side of the dome, the erosive action of the water washes salt out of the side of the dome, causing a change in domal shape whereby the top of the dome forms an overhang in somewhat of a mushroom shape. One such dome, the Barber's Hill, was the first around which extensive production was found under a salt overhang.

Gulf Coast Domes Growing

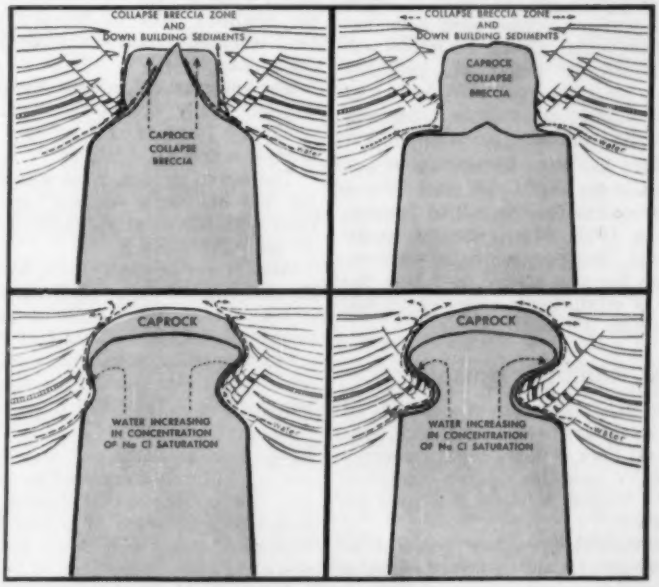
Keeping in mind how slowly Nature works, imagine the Gulf Coast basin of deposition gradually filling—as it is—with sedimentary materials carried by the streams entering the Gulf from the north and west. If this sedimentary depositing continues long enough, the Gulf will be filled.

A zone of deformation, which, simply stated, is sort of a doughnut area in the mother salt bed formed by increasing weight of ever-new sediment deposited along the Gulf's outer edge, underlays the deepest, central ocean floor of the Gulf. The newest domes forming offshore under this oceanic floor are oozing their way upward from this deformation zone as the weight of river-deposited sediments increases over and around them.

Since domes form as the strata is deposited, their tops are never far below, and are sometimes above, the surface of the sediments—the depth depends on their relative rate of growth of sediments to the rate of deposition of sediments. But because domal growth tends to slow down as the domes run out of mother salt or as



NINETEEN possible oil and gas reservoir structures are schematically shown. Consisting mainly of sand and limestone formations, these traps are formed by the combined action of the upthrusting dome and underground water erosion that causes the strata to collapse, fault, fracture, or otherwise shift and change character, forming these oil and gas traps.



UNDERGROUND WATER flowing under artesian pressure against domes' flanks and caps can effect a wide variety of cross-sections by dissolving salt. Four profile possibilities out of many known are shown above.

friction becomes too great, some of them have been deep buried by sediments deposited at a rate that outraces that of the domes' growth in old age.

The point to remember is that there was no dramatic upshooting of the salt domes through stratification already in place . . . rather, the domes rose as the sediments settled about them, weighing down their mother salt and causing them to rise. And there was ample sediment . . . the strata on the continental shelf have an estimated thickness of about 40,000 ft. This brings us to how salt domes form oil and gas traps.

The effect of that inexorably rising salt on the strata through which it's passing is the formation of these traps. As salt leaves the mother bed to feed the dome in its ascent, the strata around the dome downwarp—their salt formation is oozing out from under them. Their edges next to the salt are bent upward by the rising column. Oil and gas migrate to these upturned beds around and over the dome. These lateral strata fracture, with some sections moving further than others.

The arrangement of the fractures, or faults, about the dome can be exceedingly complex. A cross-sectional diagram (see cut) shows 19 possible oil-trap structures found about salt domes, and these can be modified by the complex faulting and deformation mentioned, or by other subterranean alterations.

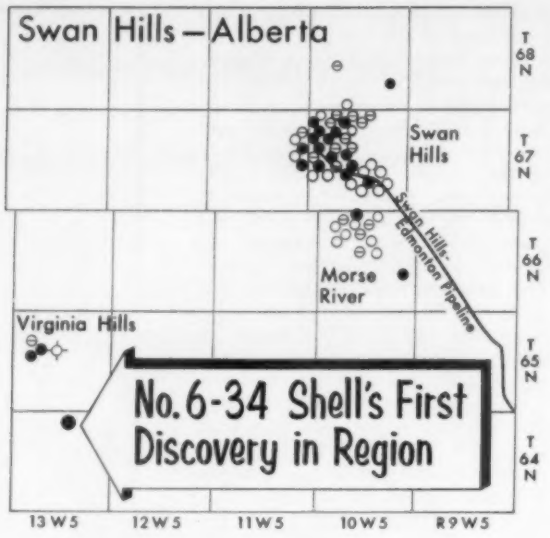
Geologically, onshore and offshore salt domes are basically alike. Economically, they differ drastically due to exploration and production costs. The shallower parts of the more coastward onshore domes have been extensively tested. Deeper reservoirs will doubtlessly be found, but probably not in the numbers of those known at lesser depths, since more shale and less sand confronts the deep driller.

Much has been learned about salt domes in the Gulf Coast since oil was discovered in the caprock of Spindletop in 1901. Much remains to be learned. The prospecting of offshore domes has just started, and here the cost of producing a barrel of oil will determine the future.

New Kentucky gasser

In the Pike County sector of Big Sandy gas field, on Bucklick Fork of Left Fork of Long Fork, Kentucky West Virginia Gas Co. has completed 6,452 William Johnson as a good gas producer.

A natural open-flow potential of 3,603 M.c.f.d. of gas was recorded along with a rock pressure of 520 psi. Pay is Mississippian Big lime 3,043 to 3,073 ft. total depth.



THE first discovery in the Swan Hills region for Shell Oil Co. of Canada, Ltd., was the 6-34 Swan Hills South.

Shell gets first Swan Hills find

SUCCESS is reported at Shell Oil Co. of Canada, Ltd., 6-34 South Swan Hills on LSD 6, 34-64-13w5, 4½ miles southeast of nearest production at Virginia Hills in Alberta's prolific Swan Hills region.

The well flowed at the hourly rate of 40 bbl. on restricted choke from Beaverhill Lake-Middle Devonian at 9,358-9,422 ft. This newest addition to the huge reservoir that is making Canadian oil history was drilled on company-owned petroleum and natural gas reservation No. 2137.

This reservation contains 46,080 acres, bought from Alberta in May 1954 for a cash bonus payment of $463,800.

North Tejon well dually completed

IN CALIFORNIA, Richfield Oil Corp. brought in a west extension to the Highway area of North Tejon field as a dual completion in two Vedder zones.

The upper, or Z-1, zone was making 242 bbl. daily net of 52.8°-gravity crude and 2,413 M.c.f.d. of gas. The interval is at 8,810-8,910 ft.

The lower, or Z-5, zone was making 404 bbl. daily of 34.3° gravity from perforations at 9,260-90, 9,310-35 and 9,290-9,310 ft.

Also in the Highway area, but on the east edge of the pool, Reserve Oil & Gas Co. reported a drill-stem-test flow rate of 1,150 bbl. daily of clean crude through a ½-in. choke on another extension test. This interval tested was at 8,813-8,975 ft.

Bridge pool extended . . . Union Oil Co. of California completed an extension test on the south edge of the Bridge pool of South Mountain field, Ventura County, with initial production of 724 bbl. daily.

Production is coming from a lower zone at 9,475 ft. The well, 1 Hill, is in NW NE 22-3n-21w.

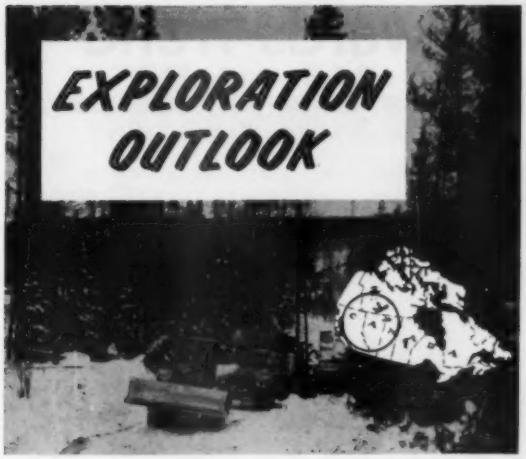
Wilmington pool find . . . Zephyr Oil Co.'s deeper "237" pool discovery on the north edge of the Wilmington field has had one offset completed in it and two drilling to it since January 1.

The first offset, 8 Lupie Leon, 2,000 ft. southeast of the discovery, started flowing to the tanks at an undisclosed rate. This well found the top of the new zone at 6,340 ft.

Zephyr was moving in a rig to deepen a 3,686-ft. well located about 1,200 ft. southwest of the new pool discovery. This well was originally completed in 1938 for 450 bbl. daily.

About 500 ft. northwest of the discovery, General American Oil Co. of Texas was nearing the pay zone depth of the "237" pool with a redrill of an older well. This well, 5 Banning, was drilling below 6,250 ft.

Desert test slated . . . Myron T. King of Rosamond was moving in a rig to drill a wildcat in the Harpers Dry Lake region 45 miles east of Mojave in 28-11n-5w, San Bernardino County. This site is in the upper Mojave Desert.



. . . appraising the future by surveying the past

LOOK TO THE NORTH COUNTRY for exploratory news of note this winter. The annual trek into the frozen muskeg domain is on in earnest. Oil-hunters are fanning out all over northern Alberta, northeastern British Columbia, and southern Northwest Territories in what may be the biggest wildcatting campaign yet for western Canada's wilderness.

Frigid Canadian weather

. . . stirs wildcatting and development operations on a wide scale. The biggest development action this winter will be at Alberta's Swan Hills giant and in British Columbia's Beatton River region.

Famed Swan Hills field is fired up to its highest drilling pitch yet. Half a dozen new oil wells were completed, and two others are nearing completion, according to Home Oil Co., Ltd., operators of the field. The eight wells make up the first portion of the big program planned here this winter. Gross pay thickness of the wells range from 278 to 395 ft. of reef with net pay running from 87 to 148 ft. Rigs have been moved from the new producers to new locations. Work is under way on the second round of the winter's drilling which should see two dozen producers on the tally sheets by spring breakup.

Wildcatting in the Swan Hills area netted one of Alberta's best oil finds of the past year at Pan American Petroleum Corp.-British American Oil Co., Ltd. A-1 Swan Hills. This well flowed 2,568 bbl. of oil per day from a gross pay section of 361 ft., of which 204 ft. was net pay. This is the thickest pay section found to date in the area. The team followed up this discovery with five new wildcat locations nearby.

British Columbia explorers are eying the Beatton River area for the winter's wildcatting and field-development news. Triad Oil Co. recently announced the current drilling plans and results to date of its Triassic "D" sand discovery which is now being completed. The well was first reported a hit 1 year ago, but summer stopped operations until now. Two more oil wells have been added to the field, and a fourth well is planned. Initial producing potentials range up to 1,000 bbl. daily with sand thickness varying from 10 to 25 ft.

Beatton River is 4 miles northwest of Milligan Creek field where Union Oil Co. reported completion of two more flowing oil wells. There are four wells in Milligan Creek. Pipeline outlet is due by summer. The pipeline plus the good potentials in these two fields will bring British Columbia exploration up to the high standing it deserves.

Remote northern wilderness

. . . fails to hinder the search for oil and gas in arctic conditions. Freezeup time brings with it a predicted jump into Canada's Northwest Territories. Shell Oil Co. of Canada, Ltd., holder of 15,000,000 acres in the territories, staked a pair of wildcats that will begin drilling operations soon. Rigs are moving to the two sites. One is in the Alexander Falls region, 65 miles south of Fort Providence; the other is at Kakisa Lake, 30 miles southwest of the Alexander Falls well and 3 miles north of the Alberta border.

Alberta's Berland River

. . . will see action this winter. Pan American Petroleum Corp. is preparing location for the A-1 Berland River, 12 miles due west of the British-American and Shell gas discovery which broke all Canadian records last year. Pan Am will take its new well down to Devonian pay at Berland River.

Pan Am will also drill an important wildcat in the general Berland River-Kaybob-Iosegun River region. The A-1 Grizzly Creek will be drilled 18 miles southwest of Kaybob field.

Another banner year in the Rockies

. . . appears imminent. Several new wildcat horizons are looming plus continued growth of established fronts and reawakening of others.

The Central Montana Plains seem to be in line for a return to Mississippian exploration. Honolulu Oil Corp.'s rich Tyler sand discovery in northwestern Rosebud County flowed 1,116 bbl. of oil per day on tests, heralding another round of wildcatting in the Sumatra area. Three offsets are already in the works with Honolulu at the wheel, while McAlester Fuel Co. is in pay sand at its 1-A Montana Federal.

Green River basin exploration this year will be on three fronts—Lincoln County on the west (two new fields here already), the southern end of the old reliable Rock Springs uplift in the middle, and further exploration around Desert Springs on the east (or Red Desert basin) end.

Northwestern Kansas' Las Animas arch success is spilling over into Hitchcock County, Nebraska again. A good oil pool was opened there in January. Meanwhile, wildcatting will rise in northwestern Kansas counties this year. Llanos field, birthplace of all this excitement, is being extended successfully in all directions.

John C. McCaslin

Drillers probe Texas' Edwards trend

A SPURT in wildcat drilling is instilling new life into Southwest Texas' "Deep" Edwards trend and stretching the play westward across the remote, meagerly explored expanse of northern Webb and southern Dimmit counties.

Impetus to the play into Webb County has been given by Copane Oil Co.'s recent Edwards gas discovery more than 35 miles southwest of the previous most southwesterly production on the trend, located at Stuart City, in southwestern LaSalle County.

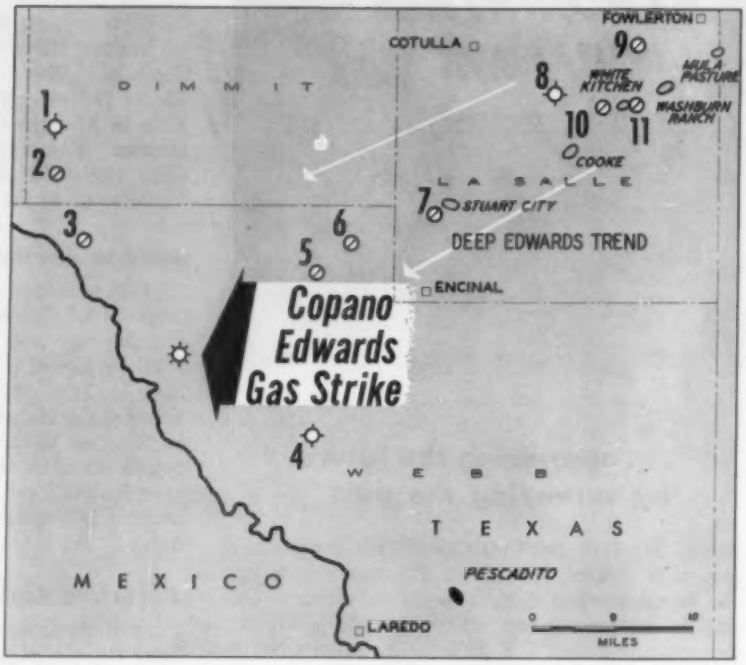
Copano's discovery well, 1 Desiderio Trevino, was completed last August with a potential flow of 2,600 M.c.f. of dry gas with its Edward pay at 8,970-9,014 ft. in hole drilled to 9,110 ft. The well is 35 miles northwest of Loredo. It is the county's first production deeper than the Eocene-Wilcox sands. The Stuart City Edwards gas field is the nearest production of any kind.

Earlier in the year, encouraging gas showings were tested in an Edwards wildcat drilled by Hamman Oil & Refining Co. 15 miles southeast of the Copano discovery. Hamman drilled its well, 1 Rosa Vela de Benavides (No. 4 on map), to 15,000 ft., logging Edwards from 13,210 ft. (surface elevation 571 ft.). The hole had been deepened from 11,679 ft., where it had been abandoned by Amerada Petroleum Co. in 1949.

Currently, Pan American Petroleum Corp. is testing gas showings in a prospective Edwards discovery well (3 on map) in the northeastern corner of the county, about midway between Copano's gas discovery and the Stuart City Edwards field in LaSalle County. This wildcat, on a ranch owned by John Nance Garner, former vice president of the United States, has been testing a succession of perforated intervals below 9,900 ft. after drilling to 10,500 ft.

Latest Edwards wildcat (No. 6 on map) to get under way is less than 5 miles northeast of Pan American's prospective discovery well, between it and Stuart City field. It is being drilled by Sutton Producing Co. on its Kone lease with Pan American holding an operating interest.

More than 25 miles west of Pan American and Sutton wildcats in the remote northwest corner of the county, L. A. Nordon, of San Antonio, is deepening to the Edwards a shallower test (No. 3 on map) recently drilled by O. N. Beer and associates. It was the first of three 5,000-ft. tests drilled in the immediate area within the last several months. Nordan has acquired all of Beer's 40,150-acre Dolph Briscoe and plans a series of deep exploratory tests. The area is more than 50 miles northwest of Laredo. Nearest production of any kind is Copano's recently completed Edwards gas-discovery well, 25 miles southeast.



REMOTE northern Webb and southern Dimmit counties lure wildcatters in extending Southwest Texas' deep Edwards trends westward from LaSalle County. Recent and new Edwards, or deeper exploration indicated on map include Copano Oil Co.'s gas discovery, and (1) Shamrock Oil & Gas Corp. 2 Fitzsimmons, (2) Gulf Oil Corp. 1 Fitzsimmons, (3) L. A. Nordan 1 Briscoe, (4) Hamman Oil & Refining Co. 1 Rosa Vela de Benavides, (5) Pan American Petroleum Corp. 1 Garner, (6) Sutton Producing Co. 1 Kone, (7) Westland Oil Development Corp.'s three tests, (8) Gilbert Brown 1 Storey, (9) Gulf Oil Corp. 1 Naylor & Jones, (10) Sutton Producing Co. 1 Hilje, (11) Lee Brothers Oil Co. 1 Beckman. Present Edwards fields, and Pescadito salt dome are shown by name.

Twelve miles northwest in the southwest corner of Dimmit County, Gulf Production Co. is making hole on a permitted 10,500-ft. test with the Edwards and Glen Rose sections as its objective. Gulf's well, 1 Hugh Fitzsimmons (No. 2 on map), is 5 miles south of a 8,265-ft. Glen Rose wildcat (No. 1) drilled last summer by Shamrock Oil & Gas Co.

Along the deep Edwards trend in LaSalle County, Gulf has another deep test going down (location No. 9 on the map) on Gulf's Naylor & Jones Ranch lease 10 miles southwest of Fowlerton and 5 miles northwest of nearest proved Edwards lime pay, located at Washburn Ranch field, discovered in 1954.

Less than 10 miles southwest, Sutton Producing Co. is drilling another deep Edwards wildcat (No. 10 on map) at its 1 Hillje. It is near West Washburn Wilcox field and was started as a 6,000-ft. Wilcox extension test. Passing the Wilcox, operators elected to carry on to the Edwards. New permit is to 10,600 ft.

Sutton's wildcat is 8 miles southeast of an Edwards and Glen Rose test (No. 8 on map) drilled by Gilbert L. Brown at 1 Storey. It went to 10,412 ft. in the Glen Rose.

New Edwards development is taking place in the Stuart City in the southwest corner of LaSalle County, where Westland Oil Development Corp. of Wichita Falls, has drilled three deep tests (No. 7 on map) within recent months. They are on a farmout from Pan American Petroleum Co., whose predecessor (Stanolind Oil & Gas Co.) discovered the field in 1954. In the White Kitchen area, Lee Brothers Oil Co. is starting a new Edwards well, 1 Beckman (No. 11 on map), to confirm a gas-discovery made by this company in 1956.

Storms hamper Michigan drilling

RECORD snow and ice storms across the entire State of Michigan have slowed drilling operations in most areas but in the face of bad weather 14 new starts were reported for the week.

These included Carter Oil Co. 1 Rosenau, 23-3s-4w, Calhoun County, north offset to the Albion discovery and Carter's first start in the southern Michigan play. Carter is carrying 1,900 acres, or approximately 50% of the leases tentatively included in the probable development area.

Faster development in the Albion and still newer Pulaski play is expected with clearing of spacing orders by the state oil supervisor. A 20-acre diagonal spacing unit has been set for the Albion district covering 14 full 640-acre sections. This follows the Scipio field pattern.

Well Supervisor Gerald Eddy handed down an emergency 21-day order for 40-acre diagonal spacing for the Pulaski play, between Albion and Scipio and set February 11 for public hearing.

McClure Oil Co. abandoned 1 Daniels, NW SE NE, 17-6s-2w, 7 miles southeast of the Scipio field, at 3,905 ft., with Trenton top at 3,423 ft. Entire section was limestone.

Ohio gets largest initial producer

The completion of what is probably the largest initial producer in Ohio's New Lexington pool was reported by the operator, Rochester and Lamp.

Their 2 J. H. Diller, Section 21, Pipe Township, Perry County, found Clinton sand at 3,392-3,426 ft. and gaged an estimated 1,000 bbl. with 500 M.c.f. gas in a 24-hour test after fracture.

New strike for Red Earth Creek

WITH WINTER DRILLING in western Canada going at a fast clip, the Red Earth Creek region is back in the exploratory spotlight.

The most recent discovery well here is Union Oil Co. of California's 4-12-87-8 Red Earth, ⅜ mile southeast of Imperial 8-11 Red Earth, a dry hole; 3½ miles southwest of another Imperial hole at 12-30 Red Earth, granite wash oil strike, and 4 miles southeast of the discovery well of the field itself at 12-17 Red Earth.

Union's new well was tested in a 50-ft. interval below 4,870 ft. Flow rate of oil was not measured. Testing continues.

Red Earth Creek . . . Union has drilled 22 wells in this field—12 were abandoned, 10 are oil producers. Granite wash oil wells make up nine of these; one is a Beaverhill Lake Middle Devonian producer. In addition to these wells, one other is now drilling. Average depth is 5,000 ft. The area so far covered by the drilling program has stretched 20 miles in a southwest-northeast direction and 11 miles wide, southeast to northwest.

Find for Sooner's Grady

Pennsylvanian Hoxbar oil production is reported at a prolific discovery well in southwestern Oklahoma's Grady County.

Sun Oil Co. 1 Huddleston in C SW NE 35-5n-7w, southwest of Northwest Chitwood field, flowed natural at the rate of 517 bbl. of 40°-gravity oil in 7¾ hours on 1-in. choke. Perforations were in the basal part of the Hoxbar at 9,602-30 ft. This flow on a daily basis would be 1,600 bbl.

(More fields on page 158)

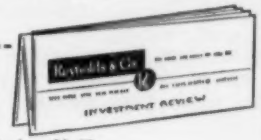
In its new Investment Review

Reynolds **Research Discusses the Natural Gas Industry, Recommends 4 Stocks**

The latest issue of Reynolds & Co.'s *Investment Review* contains an informative report on Natural Gas — one of America's largest and most consistent growth industries.

This *Review* recommends four natural gas stocks which in our professional opinion now offer excellent investment opportunities. Three of them currently yield from 3.4% to 5.3%, and, we believe, offer superior prospects of growth. A fourth stock is recommended for its attractive speculative appeal. All four companies are characterized by vast in-the-ground wealth and strong strategic positions in the natural gas industry.

Whatever your personal investment objective—Growth, Current Income, or a combination of Growth and Income — you should read about the natural gas industry in the new Reynolds *Investment Review*. For your free copy, mail the coupon below.



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Please send me a free copy of your *Investment Review* which analyzes the natural gas industry and recommends four natural gas stocks.

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Jamieson Heads Jersey Firm

. . . with South American activities. Newspaper ad steered him into career which has led to top International post.

SHEER CHANCE brought J. K. (Ken) Jamieson into the oil business.

If it hadn't been for the depression and an obscure advertisement in an Alberta newspaper 27 years ago, Jamieson might be head of a construction or engineering firm today, instead of the new president of International Petroleum Co., Ltd.

After chance or fate made the choice for him, Jamieson's talent for getting to the root of a problem and a flair for getting along with men took him from a laborer's job through every phase of the industry.

On January 1 he left a directorship and vice presidency with Imperial Oil, Ltd., in Canada to become head of International, which operates in Venezuela, Ecuador, Colombia, and Peru. Both International and Imperial are subsidiaries of Standard Oil Co. (N. J.).

Jamieson succeeds M. L. Haider as president of International. Haider has been appointed a director of Jersey Standard.

His start . . . In retrospect, Jamieson's year of crisis was 1932. Like many others at the time, he had an education—but no job.

He had attended the University of Alberta and had received a bachelor of science degree from the Massachusetts Institute of Technology.

He took any work that came along: Day laborer, welder, bush worker. When the last job petered out, he read the classifieds. He had no particular interest in oil, but the Northwest Stellarene Co. at Coutts, on the Alberta-Montana boundary, was building a thermal-cracking unit and needed a junior engineer. Jamieson got the job and later became foreman of the labor gang. But that winter the company put its men on half-time.

"I'd already put in a lot of overtime with no extra pay, so I got mad and quit," Jamieson recalls. "After a few months without work, I went back on bended knee and hired on as a laborer."

He has never regretted that "comedown." A big, blunt, rugged man, Jamieson hit it off immediately with his fellow laborers.

"I wouldn't have missed it for anything," he says. "I like to think that I understand the working man better because of it."

The small plant employed about 75 people, and "you had to do everything." Jamieson turned that situation to advantage too. He learned the industry from bottom to top. Associates say Jamieson "has a great capacity for watching and listening."

With Northwest Stellarene—which in 1934 was taken over by the British American Oil Co.—Jamieson worked at everything from pipefitter to refinery manager. By World War II he was well-versed enough in the business to serve in the oil controller's office of the Canadian Government. He returned to BA after the war, as chief

▶ ▶ ▶ Personals

William A. Adent, consulting geologist, has moved his headquarters to Sacramento, Calif., from Bakersfield, Calif.

Joseph W. McDonald, Denver area geologist for Shell Oil Co., has been transferred to the Pacific Coast area exploration department.

H. S. Erskine, district superintendent at Fairfax, Okla., for Kewanee Oil Co., has been transferred to Wichita as Kansas division superintendent. He succeeds **Robert Gray,** who has been named secondary recovery engineer in Tulsa.

Harold Eby, research group leader for Continental Oil Co. in Ponca City, Okla., has been named supervising research chemist.

Frank D. Lortscher, director of purchases and stores and special services for Signal Oil & Gas Co., has been named vice president in charge of crude-oil sales.

William T. Ford, formerly partner in Keeling & Ford, Tulsa petroleum consultant firm, has joined the National Bank of Tulsa as petroleum engineer. Ford was with Carter Oil Co., Deep Rock Oil Corp., and Keplinger & Wanenmacher before becoming a consultant in 1957.

Harry C. Long, California independent operator, has been elected chairman of the board of Aeco Corp., Beverly Hills, Calif., and president of Nordon Corp., Ltd., a subsidiary company. Aeco has acquired Mission Cities Oil Co., which was principally owned by Long.

F. J. Fayers has been named a group supervisor in California Research Corp.'s La Habra, Calif., laboratory. He will supervise research in reservoir analysis. **J. Earl Warren** also has been named group supervisor at La Habra. He will be in charge of reservoir engineering technical service to operating companies in the Standard Oil Co. of California group.

engineer and later as manager of the manufacturing department.

In 1948 he went to Imperial Oil as associate manager of the coordination and economics department in Toronto. The next year he was transferred to Sarnia to head the engineering and development division.

Sold on automation . . . In the prewar and postwar years Jamieson, with his particular interest in men and machines, watched the trend from "instrumentation in its crudest form" to automation.

Is automation really a bogey? Will machines push men out of the oil business? Jamieson thinks not. A few years ago he told a meeting of a foreman's club in Toronto, "In the oil industry there has been to my knowledge, no technological unemployment whatsoever." The new technology calls for fewer laborers but more specialists, he points out.

"Automation's the only thing that's going to keep this civilization of ours going," Jamieson says. "In our business, for example, you couldn't run the big complex units without it."

In April 1952—after a year on loan to the Department of Defense Production, where he assisted in the formation of that department's petroleum division—Jamieson was elected a director of Imperial. In 1953 he became a vice president.

The new president still cracks jokes with refinery crews. In the office, without a note to prompt him, he still fires searching questions that send associates scurrying for more basic information.

And an employe pays him the supreme compliment: "You can always get in to see him, and he'll always listen."

Edward D. Boston, section head in Esso Research & Engineering Co.'s chemicals development division, has been appointed assistant director in the chemicals research division at the company's Linden, N. J., laboratories.

George F. James, special assistant to **John F. Seal,** senior vice president of Socony Mobil Oil Co., Inc., has been elected a director of the company. James was with Standard-Vacuum Oil Co., an affiliate, before joining Socony Mobil last year. He was elected a director of Standard-Vacuum in 1951 but resigned this post in 1957 to serve as general representative for Standard - Vacuum interests in Australia.

O. H. Goodman, superintendent of production for Buffalo Petroleum Corp., has been transferred to Ozona, Tex., from Paintsville, Ky.

J. Terry Duce, Arabian-American Oil Co. vice president, has been honored by Lebanon with the award of the Order of the Cedars, Commander Class. The presentation was made at a special ceremony in Beirut.

Fred C. Beleau, district superintendent for Pan American Petroleum Corp. in Midland, Tex., has retired. Beleau joined Midwest Refining Co., a predecessor of Pan Am, in 1922. He was district superintendent at Jennings, La., and Hastings, Tex., and division drilling superintendent at Casper, Wyo., and Calgary before becoming Midland district superintendent in 1950.

Stanley D. Breitweiser, vice president and a director of D-X Sunray Oil Co., has been elected executive vice president of marketing. **Harry A. Brown,** vice president for manufacturing, and **J. Paul Greve,** assistant general attorney for Sunray Mid-Continent Oil Co., have been elected directors of D-X Sunray.

John Getgood, general sales manager for Phillips Petroleum Co., has been promoted to manager of the new foreign sales and development department. He will headquarter in New York. The new department will handle world-wide sale of crude oil for Phillips. **G. L. Lory,** an assistant sales manager, has been moved up to general sales manager replacing Getgood.

Dudley Tower, vice president of Union Oil Co., has been elected president of the Petroleum Club of Los Angeles. **Earl Hightower,** of Hightower, Gregg & Garland, will serve as vice president. **Gordon D. Campbell,** General Petroleum Corp., is treasurer. New directors include **Fred B. Behrens,** Richfield Oil Corp.; **R. A. Keans,** Keans, Springman & Stipek; and **E. Pick McIver,** consultant.

J. M. C. Graffon, Freeport Oil Co., has been elected chairman of the Delta section of AIME's Society of Petroleum Engineers. He succeeds **E. H. Leeman,** Shell Oil Co. Other officers are **Dale H. Aunspaugh,** Gulf Oil Corp., first vice chairman; **Fulton J. Olivier,** Humble Oil & Refining Co., second vice chairman; **Edwin O. Price, Jr.,** The California Co., secretary; **Leonard Leon,** Halliburton Oilwell Cementing Co., treasurer; and **Don T. Wise,** The Texas Co., journal secretary.

▶▶▶ Personals

Robert L. Boggs, Gulf Oil Corp.'s vice president for production and exploration, has arrived in Houston to head the company's domestic production office there. Gulf recently moved its production and exploration headquarters to Houston (OGJ, Newsletter, Oct. 13, 1958). Boggs was formerly in Pittsburgh. He has been with the company and its predecessors since 1927. He was active in development of the company's Lake Maracaibo holdings as assistant to the president of Mene Grande Oil Co. in Caracas and manager of operations in eastern Venezuela. He was a vice president of Mene Grande when he was transferred to New York in 1950 as manager of foreign production in the Western Hemisphere. He was transferred to Pittsburgh in 1952 and became vice president in charge of production in 1955.

L. J. Forche, executive assistant for Sinclair Oil & Gas Co., will retire this month. **F. F. Wright,** assistant chief petroleum engineer, will succeed Forche.

A. H. Trowbridge, Shreveport, La., area exploration manager for Olin Oil & Gas Corp., has been transferred to Jackson, Miss., to open an exploration office there. **Prentiss L. Boatner, Jr.,** Arkansas district geologist, has succeeded Trowbridge in Shreveport. Trowbridge was with Gulf Oil Corp. before joining Olin Oil & Gas in 1953.

C. J. Pinner, vice president of Wright-Pinner Oil Co., has joined Deep South Oil Co. of Texas as field supervisor of properties recently acquired by Deep South from Wright-Pinner. **J. Edward Jones, Jr.,** vice president of Deep South, has moved from New York to Houston to be in charge of the Houston office.

George W. Marshall, Jr., Continental Oil Co., has been elected president of the Fort Worth Geological Society. He succeeds **James R. White,** Texas Pacific Coal & Oil Co. Serving on Marshall's cabinet will be **Tom F. Newman,** Pan American Petroleum Corp., first vice president; **Joe W. Luckett,** Pure Oil Co., second vice president; **Jack R. Walker,** Sinclair Oil & Gas Co., secretary; and **A. L. Cox,** Champlin Oil & Refining Co., treasurer.

Irizarry Heads Tulsa Nomads Chapter

Tulsa Nomads inaugurated new officers January 31. Oscar Irizarry, seated third from left, editor of Petroleo Interamericano, the Journal's sister publication, is new president. Other officers are, seated, left to right, Ray Carter, Triangle Oil Co., planning committee; John Pearce, Superior Iron Works & Supply Co., senior regent; Irizarry; and Harry Horton, Tret-O-Lite Co., assistant secretary. Standing are, left to right, Guy Williams, Dowell, retiring senior regent; W. O. Timberlake, Lucey Products Corp., secretary; Vern Bailey, Bethlehem Supply Co., assistant treasurer; James Young, Reed Roller Bit Co., planning committee; Floyd Cummings, Axelson Manufacturing Co. division of U. S. Industries, treasurer; and E. M. Donovan, Martin-Decker Corp., sergeant-at-arms. Officers not pictured include Paul McGivern, McKissick Products Corp., vice president; Thomas M. Lumly, Refinery Engineering Co., junior regent; and R. R. Matthews, Alten Foundry & Machine Co., deputy sergeant-at-arms.

Bernard Wilson, production engineer with Rocket Drilling Co., Inc., has joined Jocelyn-Varn Oil Co. as production engineer and production superintendent over Oklahoma and Kansas. He will headquarter in Wichita.

H. D. Hobson, assistant manager of exploration for General Petroleum Corp., has moved up to manager of exploration. He succeeds **Victor H. King,** who was named exploration manager for Mobil International Oil Co., new operating division of Socony Mobil Oil Co., last week. Hobson has been with General Petroleum since 1940. He will take over his new post March 1.

John Duncan, field engineer in Cities Service Gas Co.'s gas measurement department, has been promoted to foreman in the Ulysses, Kans., pipeline division. **T. D. Horsburgh,** pipeline foreman in Ulysses, has been transferred to the Blackwell, Okla., division. **Leon Brinkmeyer,** foreman at Caney, Kans., has moved to Ulysses as engineer in the compressor department.

Richard A. Howe, exploration superintendent in Salt Lake City for General Petroleum Corp., has joined Socony Mobil Oil Co., the parent company, in New York as geologist.

Carlos M. Creamer, formerly assistant manager of Creole Petroleum Corp.'s marketing department, has been appointed manager. He will headquarter in Caracas. Creamer succeeds **Lionel J. Bourgeois,** who has been transferred to New York with Standard Oil Co. (N. J.), the parent company.

American Oil Co. has made six changes in its research and development department. **C. N. Sechrist,** acting group leader, has been named group leader. **B. M. Drinkard,** analytical research section, has been named senior chemist, group leader. **F. M. Jacobsen** and **F. E. James, Jr.,** group leaders, will retain this title and have also been promoted to senior chemical engineers. **R. L. Stack,** group leader, has been named administrative supervisor. **William Schoen,** petroleum section, becomes senior chemist.

Neal Clayton, Sohio Petroleum Co., has been elected 1959 president of the Southwest Louisiana Geophysical Society. Serving with him will be **John A. Standridge,** Phillips Petroleum Co., first vice president; **C. J. Seib,** Marine Exploration Co., second vice president; **Frans H. Hammons,** Pan American Petroleum Corp., secretary; **J. S. Peterson,** Sinclair Oil & Gas Co., treasurer; and **E. L. Ricketts,** Forest Oil Corp., district representative.

Harry Horton, Dowell, Odessa, Tex., has been named 1959 chairman of the Permian basin section of Society of Petroleum Engineers of AIME. **Don Brown,** Sun Oil Co., Midland, Tex., is first vice chairman. Other officers will be **Wallace Johnson,** Atlantic Refining Co., second vice chairman for Odessa; **Bill Davis,** Humble Oil & Refining Co., second vice chairman for Midland; and **L. B. Plumb,** Tennessee Gas & Oil Co., Midland, secretary-treasurer.

W. J. Goldston, president of Goldston Oil Corp., Houston, has been elected president of the Mid-Continent Oil and Gas Association. He succeeds **Charlton H. Lyons, Sr.,** Shreveport, La., independent operator. Lyons had been president since 1955. He will continue as a director. Newly elected vice presidents of the association include **Bouwe Dykstra,** Shell Oil Co., vice president for Louisiana; **Robert M. Hearin,** First National Bank of Jackson, Miss., vice president for Mississippi; and **Victor H. Lott,** Merchants National Bank of Mobile, vice president for Alabama.

S. Fred Bird, assistant chief petroleum engineer for Mobil Oil of Canada, Ltd., has been promoted to chief petroleum engineer. Bird spent 3 years as a petroleum engineer in Peru and did consulting work in Oklahoma before joining Mobil Oil of Canada in 1954 as a senior petroleum engineer. He is a graduate of the University of Oklahoma.

George L. Henderson, vice president of Kern County Land Co., is retiring after 31 years with the company. He will open consulting offices and will continue as a consultant with Kern County Land. A graduate of the University of California, Henderson became chief engineer of the company in 1930. He was appointed vice president for water resources and civil engineering activities in 1954.

Charles R. Hetherington, director and managing director of Pacific Petroleums, Ltd., and vice president of Westcoast Transmission Co., Ltd., has resigned to become a consultant. Hetherington was consulting engineer with Ford, Bacon & Davis, Inc., before joining the companies. As vice president and chief engineer of Westcoast, he had responsibilities in the early organization and construction of the pipeline system.

Harry S. Lain, formerly district geologist with The Texas Co., has joined Cosden Petroleum Corp. in Big Spring, Tex., as chief geologist. Lain was with Seaboard Oil Co. before the Texaco-Seaboard merger.

Robert F. Paulus, group engineer in the manufacturing department of Standard Oil Co. (Ohio), has been given a 2-year assignment with Iranian Oil Participants, Ltd. He will be assistant to the construction manager at the consortium's Abadan refinery.

H. M. Moorman, executive vice president of Socony Mobil Oil Co.'s Venezuelan operation, is moving to New York as vice president of Mobil International Oil Co. His successor in Venezuela will be **Spence T. Taylor,** exploration manager. **J. H. Casey** is moving into Taylor's post.

W. H. Hudson, Dallas independent operator, has been elected president and chairman of the board of Beaver Lodge Oil Corp., Dallas. **Joseph B. Avant,** independent geologist, has been named vice president. Hudson succeeds **Merle Thorpe,** who will continue as a director of the company. **Stewart Bennett** has been named general manager of operations for Beaver Lodge.

R. Paul Huggins, who retired in January as a Gulf Oil Corp. vice president, has joined Permian Oil Co., Midland, Tex., as the company's Houston area representative. Huggins became a vice president of Gulf in 1952. He was transferred from Houston to Pittsburgh in 1954 and placed in charge of domestic crude-oil and products supply. He was with Gulf 38 years before retiring.

▶▶▶ Personals

Robert C. Read, formerly vice president of Skiles Oil Corp., has been elected president and chief executive officer of the Gordon Co., Inc., Norwalk, Conn. He will supervise expansion planned for the company's petroleum and mining exploration division. Read was with Socony Mobil Oil Co. at one time.

Bart L. Jones, general manager for Gulf States Land & Industries, Inc., has been named president of the minerals division. He will headquarter in Houston. Jones was land department manager of Holmes Drilling Co. before joining Gulf States a few months ago. He was also with Shell Oil Co. at one time.

John P. Hammond, assistant general superintendent of production for Amerada Petroleum Corp., has been promoted to executive assistant. Hammond joined Amerada in 1941. He had been assistant general superintendent of production since 1951. He was president of the Society of Petroleum Engineers of AIME in 1957.

▶▶▶ Deaths

John McKeon, 85, pioneer California operator and former general manager of Richfield Oil Corp., died January 22 in Long Beach. McKeon was one of the first operators in Signal Hill and made early discoveries in the Taft-Maricopa area. He operated the first rotary drilling rig in the Coalinga field. He became general manager of Richfield after selling his McKeon Oil Co. to the company for $4.5 million. During the Spanish-American War, McKeon, a Rough Rider, saw action at San Juan Hill with Theodore Roosevelt.

Wallace R. McClendon, 70, president of Halliburton Oil Well Cementing Co. from 1950 to 1953, died recently in McAllen, Tex., after a heart attack. McClendon was Gulf Coast area manager of operations for Halliburton for many years. He became general manager of field operations in 1942, a vice president in 1943, and a director in 1947. He retired in 1953 after 3 years as president of the firm.

Harry H. Diamond, Sr., 69, Holdenville, Okla., oil man, died January 22 in a Lubbock, Tex., hospital. Diamond was visiting friends in Lubbock when he became ill.

Peter H. Curry, 88, retired Pennsylvania oil man, died January 25 in Los Angeles after a heart attack. Curry was a former president of South Penn Oil Co., Pen-Mex Fuel Co. and Curry Oil Co. He was also chairman of South Penn Natural Gas Co. and a director of the Pennzoil Co. at one time. He was a long-time friend and associate of John D. Rockefeller, Sr. Curry retired in 1946.

N. W. Nichols, 43, executive vice president and a director of Great Plains Development Co. of Canada, Ltd., Calgary, was drowned in surf near Honolulu recently. Nichols and his wife were vacationing in Hawaii. A graduate of Yale University, Nichols had been with Great Plains in Calgary since 1946.

A. M. Hendrix, Jr., 38, of Cleburne, Tex., member of a Century Geophysical Service seismograph crew, was killed near Jeffrey City, Wyo., recently when struck in the chest by a charge from a seismographic drill hole.

Willard B. Hyde, 60, inspector in Phillips Petroleum Co.'s engineering department, died January 27 in Muskogee, Okla.

Harry L. Fitzgerald, 84, retired Tulsa independent operator and head of Fitzgerald Oil Co., died January 23 in Tulsa after a 5-year illness. Fitzgerald had oil holdings in Oklahoma and Kansas.

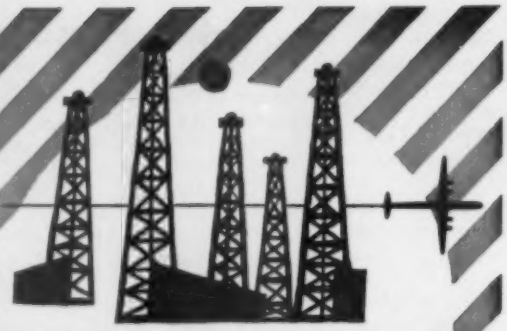
Clinton G. Johnson, 59, a director, secretary, and treasurer of Quaker State Oil Refining Corp., died January 25 in a Franklin, Pa., hospital after a short illness. Johnson was assistant treasurer of the Pennsylvania Grade Crude Oil Association. He had been with Quaker State 40 years.

J. Arter Fisher, 86, president and a director of Fisher Oil Co. and Emlow Oil Co., Pittsburgh, died January 19 while vacationing in Florida.

H. J. MacGready, 66, sales manager of Aurora Gasoline Co.'s gasoline division, died January 21 in Florida after a heart attack.

Guy R. M. Del Giudice, 54, manager of the applied research and development division of Socony Mobil Oil Co., Inc., died last week.

Elza Webb, retired civil engineer with Ohio Oil Co., died January 25 in Bristow, Okla.



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From weather to prices to yields

BY JOHN C. CASPER

THERE IS A chain reaction from cold weather to increased demand for distillates, to lower stock levels, to higher prices, to shifts in refining.

Most of the cold weather this winter has been in areas where a good percentage of home owners use distillate fuel for heating. The upper East Coast has a very high density of distillate users. This is particularly true for New England where availability of natural gas is very limited.

For the East Coast area, the greatest change in weather over last winter has been in the New England states. For example, weather in Boston through January 25 had been about 21% colder than last year, compared with 18% colder in the New York City area and 10% colder in Philadelphia. These percentages are based on the number of degree-days since the start of the heating season.

Increased demand for distillate, resulting from these low temperatures, is cutting stocks on the Gulf and East Coast. Total distillate stocks for Districts 1 and 3 amounted to only 54,283,000 bbl. on January 23, a reduction of 21,791,000 bbl. from the same week last year. This downward adjustment cut stocks for Gulf and East Coast districts 5,108,000 bbl. below the total reported for the corresponding week in 1957.

Distillate stocks in District 2 are about the same as last year, but since last year's stocks were near the 1957 level, current stocks show very little change from the third week of 1957.

Sharp reductions in distillate stocks, starting about the middle of December, have added strength to distillate markets. On the Group 3 market, distillate moved up 0.25 cent last week. Most refiners in the area are getting 10.00 cents a gallon for No. 2 fuel, but some material is reported still moving at 9.75 cents. For the first half of October, No. 2 sold for 8.75-9.00 cents a gallon. The top price for spot sales a year ago was 9.25 cents.

No. 2 fuel is selling for 9.625 cents a gallon on the Gulf Coast compared with 8.625 last fall.

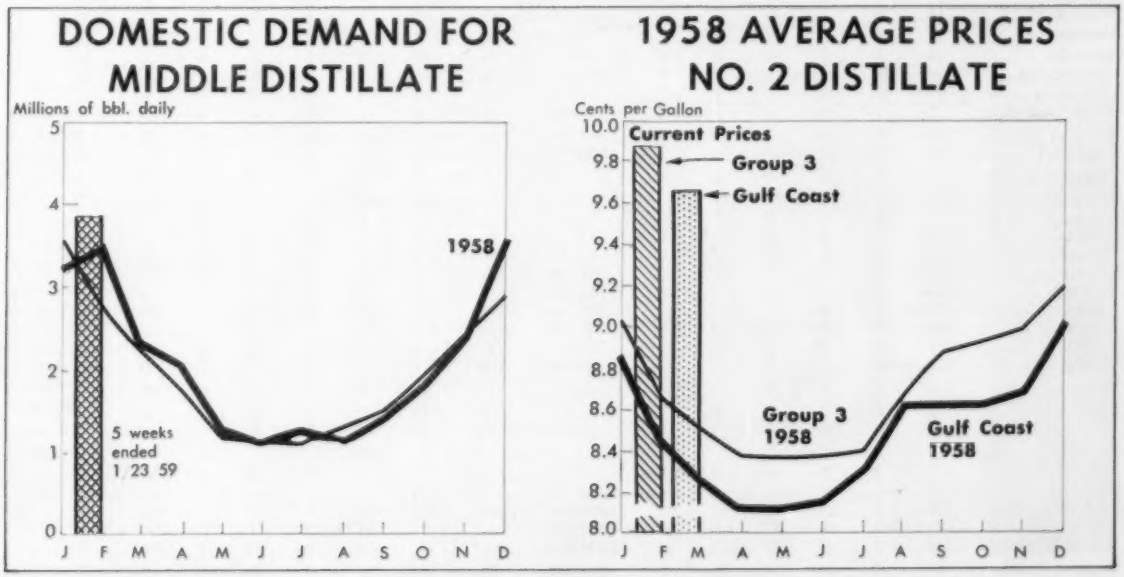
Gasoline markets are weak, both on the Gulf Coast and in the Mid-Continent. Spot sales are at heavy discounts off postings. The formal Gulf Coast posting for cargo delivery of 90-octane regular is 10.25 cents a gallon, but discounts of up to half a cent are readily available.

At a half cent off, the price for 90-octane gasoline is 9.75 cents a gallon. No. 2 fuel on the Gulf Coast is tight at 9.625 cents with some talk about another increase.

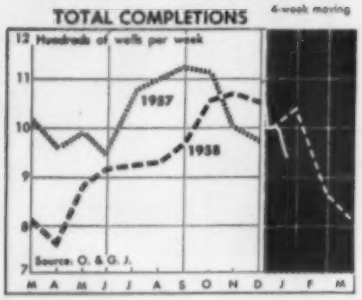
With medium-quality gasoline selling at about the price quoted for No. 2 fuel, there is little incentive for high gasoline yields. A mild shift from gasoline to distillate for the next 4 weeks will prevent losses from gasoline dumping later in the year.

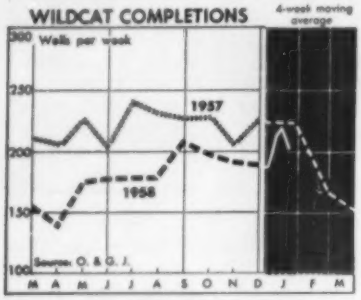
A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,200,700	UP	104,850	UP	295,218
Crude stocks	260,134,000	DOWN	121,000	DOWN	16,931,000
Completions	988	DOWN	48	UP	29
Refinery runs	8,311,000	UP	182,000	UP	672,000
Gasoline stocks	192,583,000	UP	1,835,000	DOWN	10,673,000
Kerosine stocks	21,388,000	DOWN	1,847,000	DOWN	2,663,000
Distillate stocks	100,402,000	DOWN	8,693,000	DOWN	27,779,000
Residual stocks	59,924,000	UP	556,000	UP	2,114,000
Four-product stocks	374,297,000	DOWN	8,149,000	DOWN	39,001,000
Total imports	1,567,000	DOWN	253,900	DOWN	23,800



DRILLING





Active Rotary Rigs *

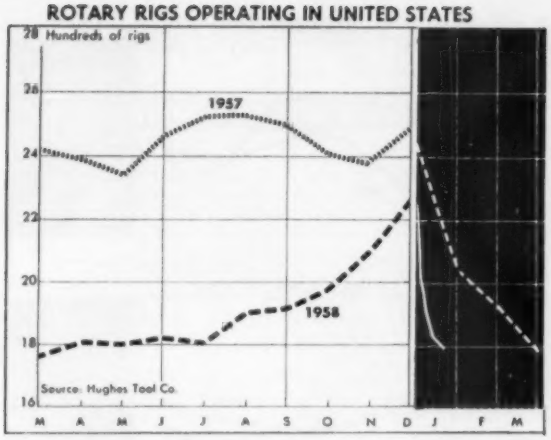
	1-26-59	1-19-59	1-27-58
Alabama	8	9	9
Arkansas	7	11	15
Arizona	....	....	1
California	79	78	89
Land	74	73	(†)
Offshore	5	5	(†)
Colorado	23	23	33
Florida	1	1	1
Illinois	39	44	24
Indiana	4	6	1
Iowa	3	3	3
Kansas	109	118	104
Kentucky	5	7	1
Louisiana	297	317	333
North	36	44	31
S.-Inland waters	130	127	(‡)
S.-Land	97	113	231
Offshore	34	33	71
Maryland	2	2	....
Michigan	11	10	7
Missouri	....	....	....
Montana	18	17	27
Mississippi	62	56	41
Nebraska	25	22	18
Nevada	....	....	....
New Mexico	100	94	107
New York	....	....	1
North Dakota	29	30	40
Ohio	4	3	3
Oklahoma	176	194	168
Oregon	....	....	....
Pennsylvania	9	11	10
South Dakota	....	....	1
Texas	694	678	720
S.-Inland waters	7	3	(‡)
S.-Land	139	124	144
Offshore	1	2	5
North-East	157	149	(†)
West Central	251	265	(†)
West	139	135	(†)
Utah	28	30	47
Washington	1	1	....
West Virginia	2	3	4
Wyoming	57	54	53
Total U. S.	1,793	1,822	1,861
Western Canada	217	203	221
Eastern Canada	....	....	1
Grand total	2,010	2,025	2,083

*Hughes Tool Co. †Comparisons not available due to change in method of reporting. ‡Included in South-Land.

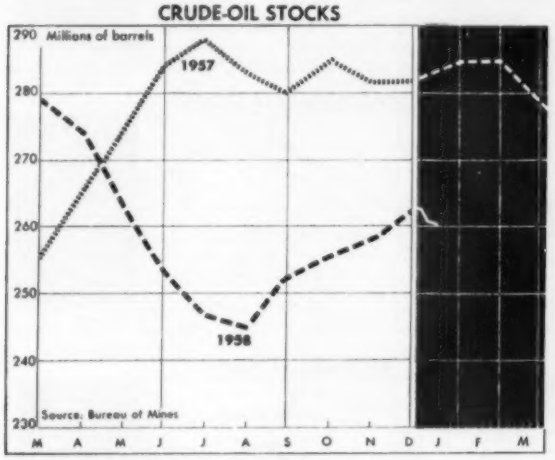
WEEKLY WELL COMPLETIONS . . . WEEK ENDED JANUARY 24, 1959

	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1959	1958	Total	Crude	Cond.	Gas	Dry	1959	1958
Alabama	4	4	0	0	0	0	46,438	14	8	0	0	0	0	0	2	4
Arkansas	17	12	0	1	4	0	68,365	71	66	2	1	0	0	1	21	13
California	17	13	0	0	4	0	112,560	125	163	2	0	0	0	2	31	26
Colorado	16	3	0	0	13	0	98,443	60	40	8	0	0	0	8	31	19
Illinois	59	34	0	0	23	2	122,050	190	116	10	0	0	0	10	34	33
Indiana	24	9	0	1	14	0	38,294	58	60	8	1	0	0	7	16	22
Kansas	82	48	0	4	28	2	290,776	339	285	15	2	0	0	13	85	74
Kentucky	29	12	0	0	15	2	27,663	122	73	3	1	0	0	2	8	10
Louisiana	82	48	9	2	23	0	569,795	283	274	16	1	0	1	14	49	41
North	40	24	0	2	14	0	125,163	107	93	8	1	0	1	6	26	22
South	32	16	7	0	9	0	343,537	147	144	8	0	0	0	8	22	19
Offshore	10	8	2	0	0	0	101,095	29	37	0	0	0	0	0	1	0
Michigan	13	2	0	4	7	0	36,613	40	22	4	1	0	0	3	11	8
Mississippi	15	6	2	0	7	0	156,023	65	40	8	1	0	0	7	35	22
Montana	7	6	0	0	1	0	37,086	24	39	0	0	0	0	0	5	21
Nebraska	8	3	0	0	5	0	46,612	41	53	5	1	0	0	4	19	26
New Mexico	24	19	0	0	5	0	107,907	110	195	5	1	0	0	4	16	33
New York	19	12	0	0	0	7	24,572	33	45	0	0	0	0	0	1	5
North Dakota	5	5	0	0	0	0	34,964	29	34	1	1	0	0	0	8	14
Ohio	29	16	0	7	6	0	87,743	51	62	0	0	0	0	0	2	2
Oklahoma	98	48	3	10	35	2	359,715	408	598	14	1	0	2	11	78	94
Pennsylvania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Texas	397	221	13	20	140	3	1,561,967	1,537	1,514	66	2	1	0	63	320	342
Dist. 1	31	16	0	0	15	0	71,801	133	67	8	0	0	0	8	30	25
Dist. 2	9	5	0	1	3	0	43,287	71	51	2	0	0	0	2	19	17
Dist. 3	13	6	1	1	5	0	86,799	86	99	2	0	0	0	2	28	20
Dist. 4	20	5	3	2	10	0	104,166	128	94	6	0	1	0	5	40	38
East	24	14	4	0	6	0	113,723	87	118	6	0	0	0	6	26	40
Dist. 7-B	71	31	0	1	37	2	179,524	197	185	16	0	0	0	16	62	53
West	133	100	1	4	28	0	645,285	454	465	18	1	0	0	17	55	79
Dist. 9	74	34	2	5	32	1	227,918	273	335	8	1	0	0	7	49	60
Dist. 10	22	10	2	6	4	0	89,464	108	100	0	0	0	0	0	11	10
Utah	8	7	0	0	1	0	40,523	22	23	0	0	0	0	0	6	5
West Virginia	13	0	0	9	0	4	42,531	53	35	1	0	0	1	0	2	0
Wyoming	19	8	0	4	7	0	84,643	60	66	5	0	0	1	4	22	29
Misc. (Nev., Tenn.)	3	0	0	0	3	0	3,755	9	14	3	0	0	0	3	7	10
Total U. S.	988	536	27	62	341	22	3,999,038	3,744	3,825	176	14	1	5	156	809	853
Prev. week	1,036	505	20	52	426	33	4,403,143	.....	.....	225	17	1	11	196	.....	.....
Cum. 1959	3,744	1,840	95	227	1,489	93	15,876,743	.....	.....	809	76	12	27	694	.....	.....
Western Canada	41	27	0	4	10	0	218,848	74	160	9	1	0	3	5	17	46

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	1-17-59	1-10-59	1-18-58
Pennsylvania	2,584	2,618	2,888
Other Appalachian	1,485	1,606	1,647
Illinois, Indiana, Michigan	10,190	10,501	10,932
Nebraska and North Dakota	2,208	1,924	2,464
Kansas	9,652	9,724	9,929
Oklahoma	16,705	16,928	19,559
Arkansas	2,105	1,989	2,764
Louisiana	17,423	17,318	19,610
North	3,140	3,096	3,129
South	14,283	14,222	16,481
Mississippi, Alabama, Florida	2,364	2,377	2,501
New Mexico	8,684	8,107	9,421
Texas	115,419	115,025	121,071
East Texas	8,278	8,729	8,677
West Texas	56,722	55,813	53,233
Texas Gulf	20,095	19,941	25,229
Other Texas	30,324	30,542	33,932
Wyoming	13,853	13,820	13,936
Other Rocky Mountain	9,420	9,049	6,836
California	34,037	33,853	36,888
Foreign	†14,005	15,416	16,619
Total	**260,134**	260,255	277,065

*Bureau of Mines. †Includes 4,700,000 bbl. in California.

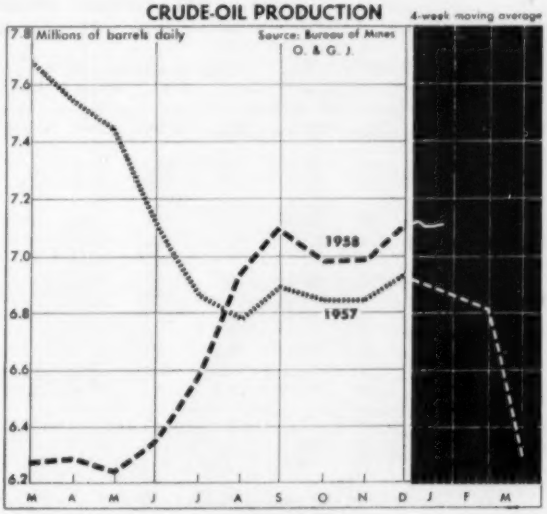
DAILY AVERAGE PRODUCTION FOR WEEK

	January 24, 1959			Jan. 17
	Crude oil	Lease condensate	Total	total
Alabama	15,675	.....	15,675	15,700
Arkansas	81,225	150	81,375	81,525
California	851,300	.....	851,300	849,400
Colorado	128,100	.....	128,100	127,900
Eastern	40,400	.....	40,400	41,000
Florida	1,200	.....	1,200	1,200
Illinois	229,500	.....	229,500	229,300
Indiana	33,000	.....	33,000	32,700
Kansas	†342,875	.....	†342,875	†298,750
Kentucky	63,500	.....	63,500	63,500
Louisiana	836,000	102,000	938,000	937,800
North	111,500	4,000	115,500	115,300
South	724,500	98,000	822,500	822,500
Michigan	23,600	.....	23,600	23,400
Mississippi	115,100	5,250	120,350	120,350
Montana	78,400	.....	78,400	78,000
Nebraska	59,000	.....	59,000	59,400
Nevada	100	.....	100	100
New Mexico	275,000	6,400	281,400	281,400
North Dakota	37,200	.....	37,200	38,400
Oklahoma	†587,100	.....	†587,100	†536,100
Texas	2,778,000	68,400	2,846,400	2,846,400
Dist. 1	43,000	1,600	44,600	44,600
Dist. 2	120,000	8,500	128,500	128,500
Dist. 3	383,000	33,500	416,500	416,500
Dist. 4	197,000	7,600	204,600	204,600
Dist. 5	31,000	500	31,500	31,500
Dist. 6	122,000	7,400	129,400	129,400
East Texas Field	161,000	.....	161,000	161,000
Dist. 7-B	142,000	150	142,150	142,150
Dist. 7-C	140,000	3,850	143,850	143,850
Dist. 8	1,125,000	2,800	1,127,800	1,127,800
Dist. 9	210,000	1,500	211,500	211,500
Dist. 10	104,000	1,000	105,000	105,000
Utah	109,300	.....	109,300	97,200
Wyoming	332,600	.....	332,600	336,000
Others	‡325	.....	‡325	‡325
Total U. S.	7,018,500	182,200	**7,200,700**	7,095,850
Change from previous week, up			**184,850**	
Canada	†603,100	.....	†603,100	†516,000

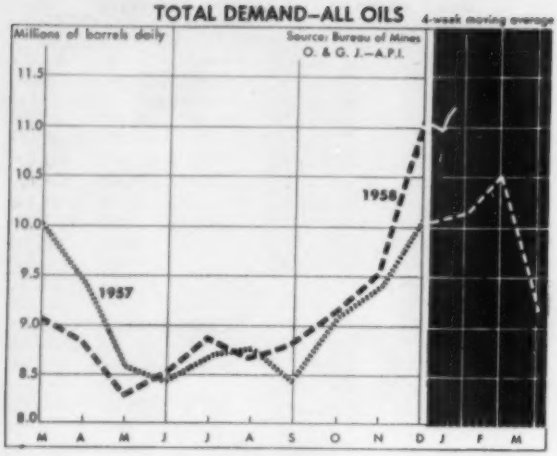
Total U. S. production—Jan. 1-Jan. 24 ..... 170,906,110 bbl.
Same period last year (crude plus cond.) ..... *165,020,408 bbl.

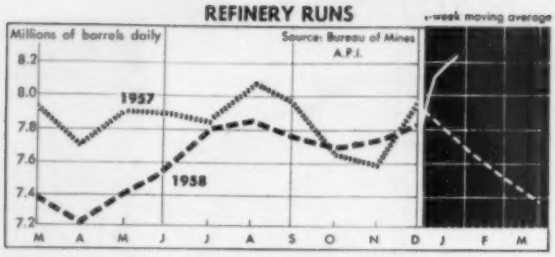
*Includes 3,850,950 bbl. condensate. †Week ended previous Monday. ‡South Dakota, Washington, and Arizona.

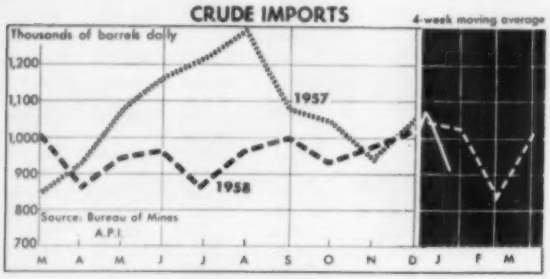
CRUDE-OIL PRODUCTION

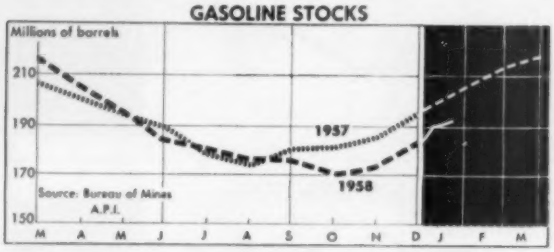


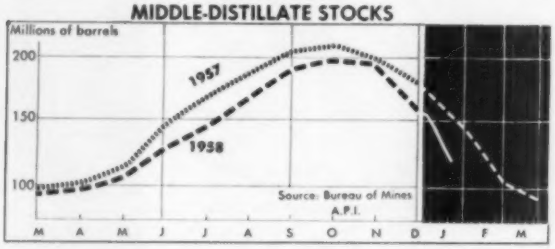
REFINING

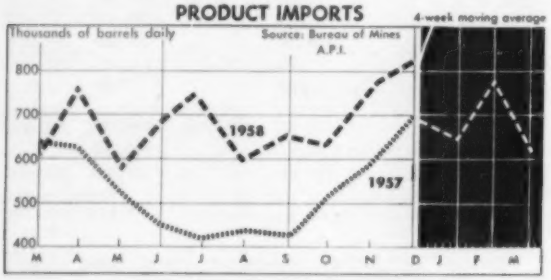

TOTAL DEMAND–ALL OILS
4-week moving average
Millions of barrels daily
Source: Bureau of Mines
O. & G. J.–A.P.I.
1957
1958
M A M J J A S O N D J F M

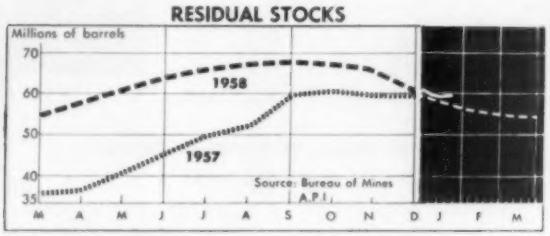












API REFINERY REFORT—JANUARY 23, 1959

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, January, 1958 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,183	542.0	17.3	411.0	208.0	41,838	9,579	34,305	11,772	1,151	502.9	35.5	338.9	194.5
Appalachian:														
District 1	103	40.0	5.8	22.3	12.4	4,587	450	2,441	304	99	40.5	4.5	25.1	9.3
District 2	117	57.9	7.9	15.9	21.2	2,844	395	960	235	93	53.4	6.8	17.4	11.1
Ind., Ill., Ky.	1,537	769.7	73.8	375.3	208.7	33,229	4,630	17,195	3,766	1,408	709.1	77.8	322.0	192.2
Minn., Wis., Dak.	108	47.9	7.9	25.0	13.0	6,678	890	5,109	548	109	50.9	5.8	29.1	13.5
Okla., Kans., Mo.	773	411.1	19.7	209.1	40.4	19,584	1,069	8,599	969	736	416.5	17.7	195.3	41.5
Inland Texas	284	201.3	9.9	44.1	20.7	7,928	246	1,858	2,179	277	192.4	11.1	51.3	20.8
Texas Gulf Coast	2,000	916.7	128.7	575.1	222.4	25,492	1,755	9,314	6,579	1,757	870.6	128.8	472.3	206.3
La. Gulf Coast	646	341.7	67.1	166.0	43.0	12,832	975	4,331	1,755	596	349.1	55.7	132.2	36.2
N. La. and Ark.	95	40.9	6.0	22.7	4.4	4,984	854	1,850	65	95	38.1	8.4	19.1	9.2
Rocky Mountain:														
New Mexico	25	13.4	0.4	4.3	2.2	598	36	184	41	23	11.3	0.3	4.3	2.7
Other Rky. Mt.	281	133.8	3.3	66.9	35.9	5,585	193	2,466	751	265	124.4	3.9	64.7	37.7
West Coast	1,159	498.0	4.3	206.4	279.0	26,404	316	11,790	30,960	1,063	467.9	5.1	169.1	313.7
Jan. 23, 1959	8,311	4,014.4	352.1	2,144.1	1,111.3	192,583	21,388	100,402	59,924	7,672	3,827.1	361.4	1,840.8	1,088.7
Jan. 16, 1959	8,129	4,069.7	476.3	2,107.3	1,089.9	190,748	23,235	109,095	59,368	.....	.....	.....	.....	.....
Jan. 24, 1958	7,639	3,778.4	342.4	1,791.6	1,060.6	203,256	24,051	128,181	57,810	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):

★ Regular (89 octane)	11.25-11.625
★ Premium (99 octane)	14.25-14.625

Gulf Coast (cargoes for coastwise or export movements):

★ Regular (90 octane)	9.75-10.25
★ Regular (92 octane)	10.00-10.50
★ Premium (97 octane)	11.125-11.625
★ Premium (98 octane)	11.25-11.75

California (rack) (Los Angeles):

Regular (88 octane)	12.25
Premium (94 octane)	13.25
Premium (98 octane)	14.25

Caribbean area (cargoes):

Regular (87 octane)	9.875
Premium (97 octane)	11.625

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:

Grade 26-70	4.5

Breckenridge:

Grade 26-70	4.0

*If 26-70 natural is considered as 100%, prices for lower-vapor-pressure grades increase 2.5% for each unit drop in Reid vapor pressure down to and including 16 lb. Prices for grades below 16 lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):

★ Kerosine 42-44	10.75-11.00
★ Diesel oil (58 d.i. and above)	10.50-10.75
★ Distillate No. 1	10.50-10.75
★ Distillate No. 2	9.75-10.00

Gulf Coast (cargoes):

Kerosine 41-43	10.125
Distillate No. 2	9.625

New York Harbor (barges):

Kerosine 41-43	11.50
Distillate No. 2	11.00
Diesel fuel, 48-52 d.i.	11.25

Caribbean area (cargoes):

Distillate No. 2	9.625

WAX (LB.)

Oklahoma (Group 3):

132-135 A.m.p. (semi-refined) in tank car	6.50

New York (export):

126-130 A.m.p. crude-scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):

★ Residual fuel (max. 1% S)	$1.95-2.00

Gulf Coast (cargoes):

Bunker C fuel	$2.00

New York Harbor (barges):

Bunker C fuel	$2.37

Caribbean (cargoes):

Bunker C	$2.00

California (rack):

Bunker C fuel, Los Angeles	$2.15

LUBRICATING OILS

Mid-Continent (Group 3):

150-160 bright stock, solvent refined, 0-10 pp., 95 v.i.	23.0
200 vis. neutral oil, solvent refined, 0-10 pp., 95 v.i.	20.5

Pennsylvania Grade:

145-155 vis. at 210, bright stock, 8 color, 25 p.t.	22
200 vis. neutral (180° at 100°), 25 p.t.	21

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	★Signal Hill, Calif.	Oklahoma*	Gulf Coast Tex.†	West§ Tex.‡ N.M.	Wyo. (sour)
14-14.9	$1.86	....	....	....	....
15-15.9	1.95	....	....	....	$1.81
16-16.9	2.04	....	....	....	1.86
17-17.9	2.13	....	....	....	1.91
18-18.9	2.23	....	....	....	1.96
19-19.9	2.32	....	....	....	2.01
20-20.9	2.41	$2.52	....	$2.62	2.06
21-21.9	2.50	2.55	....	2.64	2.11
22-22.9	2.60	2.58	....	2.66	2.16
23-23.9	2.69	2.61	$3.44	2.68	2.21
24-24.9	2.78	2.64	3.46	2.70	2.26
25-25.9	2.84	2.67	3.48	2.72	2.31
26-26.9	2.90	2.70	3.50	2.74	2.36
27-27.9	2.95	2.73	3.52	2.76	2.49
28-28.9	3.01	2.76	3.54	2.78	2.54
29-29.9	3.07	2.79	3.56	2.80	2.59
30-30.9	3.12	2.82	....	2.82	2.63
31-31.9	3.20	2.85	....	2.84	2.67
32-32.9	3.27	2.88	....	2.86	2.71
33-33.9	3.34	2.91	....	2.88	2.75
34-34.9	3.41	2.94	....	2.90	2.79
35-35.9	3.47	2.97	....	2.92	2.83
36-36.9	3.52	3.00	....	2.94	2.87
37-37.9	3.56	3.02	....	2.96	2.89
38-38.9	....	3.04	....	2.98	2.91
39-39.9	....	3.06	....	3.00	2.93
40-44.9	....	3.08	....	3.02	2.95

*Another Oklahoma (sweet) schedule has a top of $3.05 with different gravity variations to $2.34 for below 20°. †Low cold test crude. ‡Sour. §Some 15 cents lower, other 7 cents lower for 40°.

Effective dates of broad changes: California, 1-26-59; East of California, January 3-10, 1957; Pennsylvania Grade 12-22-58.

FLAT PRICES

Louisiana:

Sweet Lake	$3.00
Ville Platte	3.30

Texas:

East Texas	3.25
Conroe	3.53
Van	3.08

Pennsylvania Grade:

Bradford	4.05
Middle District	3.87
Southwest Pennsylvania	3.58
West Virginia	3.40
Buckeye Grade	3.25

Illinois Basin	**3.00**

Canada:

Leduc-Woodbend	2.67
Redwater (Alta.)	2.56
Smiley (Sask.)	2.33
Pembina	2.52

FOREIGN

Venezuela:

Cumarebo, 48°-49.9°, Tucupido	3.66
San Joaquin, 41°-41.9°, Puerto La Cruz	3.25
Oficina, 35°-35.9°, Puerto La Cruz	3.05
Tia Juana medium, 26°-26.9°, Amuay*	2.55
Quiriquire, 16.0°-16.4°, Caripito	2.15
Lagunillas heavy, flat, Las Piedras*	2.10
Bachaquero, flat, 15°-16°, Las Piedras*	1.93

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):

Arabian, 36.0°-36.9°, Ras Tanura	$2.12
Iranian, 34.0°-34.9°, Bandar Masur	2.04
Iranian, 34.0°-34.9°, Ababan	1.99
Iraq, 35.0°-35.9°, Fao	1.98
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.85
Qatar, 41.0°-41.9°, Umm Said	2.23

Middle East, E. Mediterranean:

Arabian, 36.0°-36.9°, Sidon	2.49
Iraq, 36.0°-36.9°, Tripoli, Banias	2.49

Far East (cargoes, f.o.b. Lutong, Sarawak):

Seria Light, 37°	2.75

TANKER RATES PER LONG TON
(Latest reported spot fixtures)

★ Gulf-U.S.N.H., clean (ATRS+12.5%)	$3.21
★ Carib.-U.S.N.H., dirty (ATRS—55%)	1.24
★ Carib.-U.S.N.H., clean (ATRS—45%)	1.51
★ Carib.-U.K., dirty (Scale—50%) (16s. 3d.)	2.28
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FOR SALE—6—100 Watt General Electric 2-Way radios. Van-Riner Drilling Company, 1005 City National Bldg., Oklahoma City.

USED PIPE AND USED TANKS—For Sale. Rogers & Wright, Incorporated, 216 West Second Street, Tulsa, Oklahoma; 710 Peoples Building, Charleston, West Virginia.

3,200'—3½" HUGHES Internal-Flush Drillpipe, located Seminole, Oklahoma. Markwell Drilling Corp. 111 N.W. 23, Oklahoma City—JAckson 8-5896

FOR SALE—3 Ingersoll-Rand XVG-6 gas engine compressors. Also one Clark RA-4; 2 Clark RA-32. Box L-155, The Oil and Gas Journal, Tulsa, Oklahoma.

SALES AND RENTALS. Used cable drilling and fishing tools, casing, production equipment; from the Southwest's largest stock of oil field supplies. Degen Pipe and Supply Co., Tulsa.

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$475,000 buys five complete rotary rigs, A-1 condition, Cardwell Drawworks, all alike, three now drilling. All in U.S.A., immediate delivery.

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604 Petroleum Building; Phone AM 5-2811;
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4—4,500 sq. ft. Admiralty Heat Exchangers
3—Clark Gas Compressors, 500 HP.
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2—Reactors, 8' x 34'9", Disp. Plates.
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POplar 3-3505

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500,000 FT. 8" PIPE. Wt. 28#. Lapweld plain end beveled. 20 or 40 ft. lgths. Also 35,000 ft. 40# 10" all No. 1. Indiana-Ohio Pipe Co. Phone 3-4674. P. O. Box 323—Decatur, Indiana.

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One U-15 powered by 2 NKR Waukesha engines

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ABILENE, TEXAS
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6'x36' 10 Tray 480#
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8'x75' 20 Tray 25#
5'x96' 40 Tray 135#
2'x45' 24 Tray
18"x32' 15 Tray 160#
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TWO 5x8 SLUSH PUMPS or 6x12 or 7½x8. Must be late models and in good shape. Send complete information and price to Hare Equipment Co., 2018 W. T. Waggoner Bldg., Ft. Worth 2, Texas.

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CABLE TOOL DRILLERS. State age, height, weight, companies worked for, rigs run and size of some holes drilled in the past ten years. Only competent, steady and non-drinking drillers need apply. Steady work. Good wages. Benefits. Write to Layne-Northwest Company, 6005 West Martin Drive, Milwaukee 13, Wisconsin.

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Aggressive and expanding corporation needs sales engineer with experience in gas dehydration, cold separation, and treating equipment. Previous selling experience not required. All replies strictly confidential. Send complete resume to:
Graver Tank & Manufacturing Co.
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TRANSLATORS. Proven ability to translate technical material into fluent English essential. Attractive full time or free-lance arrangement. All languag s of interest, particularly Russian. Send resume to A.T.S., Inc., Drawer 271, East Orange, New Jersey.

PETROLEUM ANALYST—Graduate chemist or chemical engineer with experience in a refinery or petroleum research laboratory wanted by a research corporation located in Florida, to perform analysis and treatment of crude oil, and research and development work on new equipment. Salary commensurate with experience and background. Excellent opportunity. Send photograph and complete resumé of experience, education, and salary requirements to Box L-147, The Oil and Gas Journal, Tulsa, Oklahoma.

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CLEVELAND HONE & MFG. CO.
8816 Harkness Rd., Cleveland 6, Ohio

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Progressive independent refiner (13,500 BPD) offers excellent opportunity for young chemical engineer. Modern plant located in the heart of a growing petroleum area. Some experience required. Send resume and salary requirements to:

Personnel Manager
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Must be thoroughly experienced to work in Desert Area of North Africa. Give full references and experience background.

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Write giving full particulars of personal history and work experience to:

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EXPERIENCED TRANSLATOR—Scientific Russian translated with speed and accuracy. Have specialized for four years in fields of Geology and Chemistry. Box L-171, The Oil and Gas Journal, Tulsa, Oklahoma.

REFINERY ACCOUNTANT—Six years refinery experience, 3 years Chief Accountant—light oil and lube. Three years C.P.A. experience. Degree. Age—37. Married. Best references. Box L-169, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOPHYSICIST experienced as Party Chief Seismologist and Seismic Supervisor. Have broad cross section. Box L-170, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST, 28, BS 1956, married, 56 hours Geology plus Physics, Chemistry, Calculus. 2½ years experience with present employer, major oil company, as economic evaluator of drilling, secondary recovery, etc. projects. Desires position with future as Geologist with oil company. Box L-162, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOPHYSICIST, 8 years experience. Last position held Geophysical Supervisor. Foreign experience. Prefer foreign—domestic acceptable. Box L-161, The Oil and Gas Journal, Tulsa, Oklahoma.

PRODUCTION - EXPLORATION - MANAGEMENT—Oil and Gas, West Central & South Texas. 6 years Independent Producer and Consultant. 2 Years Chief Geologist and Engineer. Land, Gas purchasing, Contracts. Excellent references. Desires position with well financed aggressive Independent or Investment Syndicate. Box L-164, The Oil and Gas Journal, Tulsa, Oklahoma.

ATTORNEY-GRADUATE ENGINEER, 34, desires legal or executive position. Presently employed in oil and gas. Accustomed to high level negotiating. Box L-166, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATION WANTED

GEOLOGIST desires position as Geologist, B.S. 1958, no experience, age 26, married, one son. Willing to learn and travel—Wallis Perry, 1910 Howard—San Antonio, Texas.

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GEOLOGICAL ENGINEER—Degree. Age 27. Three years experience with Electric logging Co. Prefer geological work. Available immediately. Box L-154, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST—Have found over $3 million worth of oil for Independents in the last 18 months. Permanent office in Ark.-La.-Tex. Desire contact with group with adequate financing for exploration and development. Resume on request. Box L-141, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOPHYSICIST—Nine years experience, seven states. Includes wide variety reflection techniques, some refraction, utilization of gravity and magnetics, coordinating with overall exploration effort. Degree in geology. Excellent references, will relocate anywhere. Box L-139, The Oil and Gas Journal, Tulsa, Oklahoma.

PIPELINE ENGINEER: Graduate mechanical. Ten years pipeline experience; products and gas. Desires responsible position with established company in U. S. Box L-137, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST—BS, 56. Single. Desires foreign work. Box L-158, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST, 30, M.S. 3½ years experience Mid-Continent. Desire position with opportunity for responsibility and advancement. Box L-167, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPLORATION GEOLOGIST, 40, family, 11 years experience, 3 majors, 6 years with active Independent, 2 consulting, oil-finding record. Have worked Permian Basin, Panhandle—North and West-Central Texas, 4-Corner, Uinta and Western Kansas. Prefer established, aggressive Independent who rewards success. Box L-172, The Oil and Gas Journal, Tulsa, Oklahoma.

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Desire position with drilling contractor or oil company with progressive drilling program. Onshore or offshore. Thorough understanding of drilling problems and mud control. P.E. Degree. Registered Engineer. Experience (12 yrs.) California, Texas and Oklahoma. Will relocate—anywhere in U. S. Good references. Resume on request.

Box L-145, The Oil and Gas Journal, Tulsa, Oklahoma.

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BOX L-168, THE OIL AND GAS JOURNAL, TULSA, OKLAHOMA.

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FOR SALE—Oil & Gas Leases and Drilling blocks in Kentucky—write Harvey Daugherty—Horse Branch, Ky.

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WANT SHALLOW ACREAGE for three well test program, offset or extension, preferably farmout. Write U. S. Anderson, 8350 Santa Monica Blvd., Los Angeles 46, California.

FOR SALE—Government 40 acre oil leases in Arizona, N. M. & Calif. You do no drilling yet. You share in fortunes made from oil on public lands. Payments if desired. Free information & maps of booming areas. Bids now accepted via mail. Universal Investors Corp. 30 W. Washington Street, Chicago 2, Illinois.

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PRODUCTION WANTED—Oil and Gas. We are principals, highest banking references. All submissions will be held in strict confidence. Box L-156, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: Oil properties. 100 to 5,000 barrels daily in Oklahoma and Kansas. Morris Sitrin, P O Box 1160, Tulsa, Okla.

UNLIMITED FUNDS for purchase of oil and gas properties or producing company in North, West, West-Central Texas. Negotiations in strictest confidence. Box 743, Abilene, Texas.

BUSINESS OPPORTUNITIES

NEW PRODUCTS WANTED—Well-established, responsible company with complete facilities for developing, manufacturing and marketing oil field equipment is seeking new or improved products, preferably patented or patentable, to add to its presently well-known line. Royalty basis or outright purchase. Initial submission should identify product and general use without revealing engineering and confidential detail. Submissions will be handled promptly and confidentially. Box K-994, The Oil and Gas Journal, Tulsa, Oklahoma.

ROYALTIES

HIGHEST PRICE PAID for oil and gas income royalties, overrides, oil properties. A. S. Berry, 109 Midco Bldg., 302 South Cheyenne, Tulsa, Oklahoma.

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Discovery wells

ARKANSAS

Lafayette County: Milton Crow, Inc. 2 Hodnett heirs, C SW SE 17-15s-23w, IP 120 BOPD, 18°, Tokio 2,185-90 ft. TD 6,580 ft. Discovery of East Midway field.

Coulson Drilling Co. 1 R. R. Cornelius, C NW SE 32-16s-23w. IP 48 M.M.c.f.d., Smackover Ford 8,130½-38½ ft. TD 8,271 ft.

COLORADO

Jackson County: Gulf Oil Corp. 1 Ballinger-Federal, C SW SE 8-9n-78w. IP 181 BOPD, 48.7°, Muddy 5,142-48 ft., 5,124-40 ft., 5,120-22 ft., 5,111-13 ft.; Dakota 5,201-04 ft. TD 5,609 ft. Discovery.

Logan County: Bob Burch and Midwest and Murphy Oil Co. 1 Casement, C NE SE 8-11n-54w. IP 196 BOPD, Dakota 5,376-86 ft. TD 5,475 ft. Discovery.

Montezuma County: The California Co. 2 Calco-Superior-Ute Tribal, 15-34n-20w. IP 38 BOPD, 24 BWPD, 40.5°, Paradox 5,761-66 ft., 5,770-81 ft., 5,705-14 ft., 5,818-38 ft., 5,846-52 ft. TD 6,055 ft. Opens Marble Wash field.

Rio Blanco County: Argo Oil Co. 1 Government-Sloan, 27-4s-103w. IP 13,230 M.c.f.d., Dakota 5,988-6,004 ft., 6,008-6,016 ft.; Morrison 6,276-93 ft., 6,296-6,303 ft., 6,311-21 ft. TD 6,308 ft. Opens Evacuation Creek field.

ILLINOIS

Coles County: Walter Reason, Jr. 1 Coyle, 1-12n-10e. IP 200 M.c.f.d., Penn. 390-408 ft. TD 419 ft. Extension to Ashmore field.

Jefferson County: E&G Drilling Co. 1 Harvey Keneipp, SW SE 5-1s-3e. IP 45 BOPD, McClosky 2,611-15 ft. TD 2,615 ft. Extension to Kell pool.

Macoupin County: M. D. Burkett 1 Charles Schmidt, SW¼ 22-8n-7w. IP 610 M.c.f.d., Penn. 525-540 ft. TD 540 ft. Opens Gillespie East pool.

W. C. Stribling 1 Denby, NE SW 18-9n-7w. IP 1,250 M.c.f.d., Penn. 364-373 ft. TD 373 ft. Extension to Carlinville pool.

Wayne County: Kingwood Oil Co. 1 S. E. Talbert, SW NW SE 32-1n-6e. IP 33 BOPD, 19 BWPD, Aux Vases 3,123-48 ft. TD 3,305 ft. Extension to Johnsonville Consolidated field.

INDIANA

Gibson County: Highland 1 Willard Winget, SW SE NE 21-2s-9w. IP 120 BOPD, Cypress 1,502-20 ft. TD 1,627 ft. Extension to Francisco Central pool.

T. W. George 1 Earl Rexing, NE SE SW 28-3s-10w. IP 90 BOPD, Jackson sand 1,762-68 ft. TD 2,160 ft. Opens West Fork pool.

A. Fritz 1 R. Lefler Community, NW SW NE 6-3s-9w. IP 35 BOPD, Hardinsburg 1,552-58 ft. TD 1,737 ft. Extension to Barrett-Mitchell pool.

Spencer County; Grant Mullenax 1 Fred Heilman, NW SW NW 26-4s-5w. IP 10 BOPD, McClosky 932-940 ft. TD 940 ft. Opens South Mariah Hill pool.

F. Farrar 2 Kinney "B", SW NW SE 13-6s-7w. IP 115 BOPD, McClosky 1,488-96 ft. TD 1,539 ft. New pay in McClosky pool.

KANSAS

Edwards County: Chief Drilling Co. et al. 1 M. Breitenbach 3-25s-16w. IP 2

M.M.c.f.d., 7 BOPD, Mississippian 4,278-86 ft. TD 4,408 ft. New pay in Belpree pool.

L. C. Smitherman 1 Bryant, NW¼ 2-26s-16w. IP 28 BOPD, 35°, congl. 4,415-23 ft. TD 4,423 ft. Opens South Wil pool.

Ellis County: J. Farmer 1 Bowlby, SE SW SE 27-11s-16w. IP 27 BOPD, 10% basic sediment and water, 37°, Lansing 3,222-26 ft., 3,166-70 ft., 3042-45 ft. TD 3,405 ft. New pay in Chrisler pool.

Graham County: Burch Drilling Co. 1 Goff, 33-7s-24w. IP 163 BOPD, 41°, Lansing 3,873-77 ft. TD 3,935 ft. Opens Nana pool.

McPherson County: Time Petroleum Co. 1 Southwest College, SE SE SW 2-20s-4w. IP 50 BOPD, 36.7°, TD 3,792 ft. Opens Northeast Groveland pool.

Ingling et al. 1 H. Stucky, NW SE NW 22-20s-3w. IP 1,500 M.c.f.d., Miss. 3,075-97 ft. TD 3,097 ft. Shut-in gas well. Opens Elyria pool.

Norton County: K&E Drilling Co. 1 Spiess, NW NW SW 35-5s-25w. IP 75 BOPD, 35°, Lansing 3,645-48 ft. TD 4,055 ft. Opens Spiess pool.

Rawlins County: Jackson, Shear & Parker 1 Waterman, C SE SE 15-4s-33w. IP 120 BOPD, 4 BWPD, 36°, Marmaton 4,280-88 ft. TD 4,500 ft. New field.

Reno County: Natural Gas & Oil Corp. 1 Woodson, E½ NE NW 28-26s-9w. IP 2 M.M.c.f.d., Miss. 3,924-32 ft. TD 4,377 ft. Gas discovery.

Sedgwick County: Gaty Oil Co. 1 Schwemmer, N½ NW SW 12-25s-2e. IP 8 BOPD, 44°, 2,784-86 ft. TD 2,802 ft. New pay in Neuman pool.

Stafford County: Alpine 1 Ratzlaff, NE NE NE 16-21s-14w. IP 73 BOPD, 38°, Viola 3,690-3,700 ft. TD 3,764 ft. New pay in Taylor pool.

Stanton County: Robinson Brothers Oil Co. 1 Hume, C NW 26-30s-43w. IP 2,300 M.c.f.d., Morrow 5,270-87 ft., 5,295-5,330 ft. TD 5,522 ft.

KENTUCKY

Hopkins County: Stouder Drilling Co. et al. 1 Clements, 20-I-25. IP 26 BOPD, 7 BWPD, O'Hara 1,986-89 ft. TD 1,990 ft. Opens East Nortonville pool.

Muhlenberg County: Ryan Oil Co. 1 William Glowe, 6-I-27. IP 1 BOPD, 10 BWPD, McClosky 2,023-27 ft. TD 2,088 ft. West extension to Yergens.

Ohio County: J. C. Miller at al. 1 C. Harrell, 3-K-30. IP 200 BOPD, McClosky 2,198-2,204 ft., 2,209-2,217 ft. TD 2,218 ft. Opens Hickory Ridge field.

NORTH LOUISIANA

DeSoto Parish: Daly Drilling & Producing Co. 1 Allen, SWc 13-12n-12w. IP ? Palux 2,650-60 ft. TD 3,004 ft. Discovery named North Trenton field.

R. A. Graddy, Trust 1 L. B. Gabley, C NE SE 35-13n-15w. IP 115 BOPD, 32.7°, Glen Rose 4,162-72 ft. TD 6,871 ft. Discovery named North Logansport pool.

LaSalle Parish: Sadie Workover, Inc. 1 Urania Lumber Co., C NE NE NW 2-6n-3e. IP 17 BOPD, 543 BWPD, Cane River 2,599-2,601 ft. TD 2,620 ft. New pay in West Catahoula Lake field.

Red River Parish: T. J. Johnson 1 International Paper Co.. C NW NW NE 11 13n-10w. IP 37 BOPD, 42.5°, Tuscaloosa 2,657-65 ft. TD 2,668 ft. Opens Red River-Bull Bayou field.

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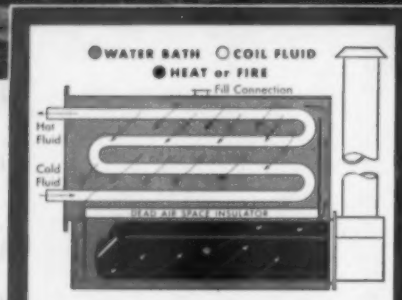

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